Buddha Pushkar Revisited: Technological variability in Late Palaeolithic stone tools at the Thar Desert margin, India

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Abstract:

The terminology used to describe Palaeolithic industries has an important impact upon our interpretation of past behaviour. In South Asia, the term Late Palaeolithic is employed to refer to Late Pleistocene microlithic industries, distinguishing them chronologically from Holocene Mesolithic industries, and technologically from preceding Middle Palaeolithic technologies. Historically, however, an intermediate technological stage between Middle Palaeolithic and microlithic industries has been recognised and called 'Upper' Palaeolithic. Examining whether these 'Upper' Palaeolithic industries fit contemporary definitions of Middle or Late Palaeolithic technologies, distinct diversity within one of these technologies or a transitional phase between the two is therefore necessary to reintegrate these 'Upper' Palaeolithic sites into current debate. This is a particularly timely issue as the connection between some Late Palaeolithic artefact types, particularly backed microliths, and the earliest modern human populations in South Asia no longer appears tenable, and thus a rush to identify the earliest appearance of microliths must give way to more detailed examinations of behavioural variability. This paper re-examines lithic assemblages from Buddha Pushkar, western India, originally reported as an 'Upper' Palaeolithic industry. An attribute study of metric and categorical variables recorded on stone tools is used to examine how flaking technology, raw material use and reduction intensity vary within and between these assemblages. The results indicate raw material choices had a marked impact on stone tool technologies, nested within a pattern of technological diversity in western India during the terminal Pleistocene that complement models of regional trajectories in the evolution of Late Palaeolithic technologies.

Key Words: Late Palaeolithic; South Asia; Thar Desert; lithic technology; MIS 2

1) Introduction:

Late Palaeolithic stone tool industries in South Asia comprise a widespread and enduring adaptation to the region's mosaic of habitats, that spans desert to savannah scrub, and from broad alluvial plains to tropical rainforest (Figure 1). These broadly comprise Upper Pleistocene lithic industries focused upon the production of small flakes and blades, often referred to as microliths, that are retouched in diverse ways and particularly as preparation for hafting in composite tools. Late Palaeolithic stone tool technologies begin to appear in the archaeological record from ~45 thousand years ago (ka) in South Asia (Basak et al., 2014; Mishra et al., 2013) and remain in use by hunter-gatherer populations for much of the Holocene, when they are referred to as Mesolithic industries. Non-lithic forms of material culture, such as beads, bone/antler tools and burials, first appear in the archaeological record of South Asia accompanying these Late Palaeolithic lithic industries (Clarkson et al., 2009; Deraniyagala, 1992; Perera et al., 2011; Sali, 1989). This broadly coincides with evidence for increases in population sizes in the region (Atkinson et al., 2007; Petraglia et al., 2009), and the change from more stable, warm and humid climates of early Marine Isotope Stage (MIS) 3 to higher levels of flux in the latter phases of this stage (Blinkhorn & Petraglia, 2017).

In recent debate, the associations between modern humans and Late Palaeolithic toolkits has led them to have been identified as potentially the earliest evidence for modern human colonisation of the region (e.g. Mellars et al., 2013; Mishra et al., 2013). This has resulted in increased emphasis on the appearance of specific artefact forms, such as backed crescents, and typological homogeneity amongst Late Palaeolithic industries in contrast to preceding Middle Palaeolithic assemblages, but without clear comparative studies. The single, late dispersal from Africa across Asia after 60ka that underlies such assertions can no longer be reconciled with a growing body of inter-regional and interdisciplinary evidence for earlier expansions (Bae et al., 2017). Rather, wider patterns in Late Pleistocene hominin demography in Asia are consistent with an alternate appraisal of cultural change in South Asia, which identify the gradual development of Late Palaeolithic technologies from earlier Middle Palaeolithic tool kits (see Blinkhorn & Petraglia, 2017). While the appearance of Late Palaeolithic industries in South Asia may no longer point to the earliest expansions of modern humans from Africa, their fluorescence within the region attests to adaptations to the Indian subcontinents unique mosaic of ecologies and establishment of behavioural trajectories that extend into the Holocene that are an important focus of study in their own right.

The history of research into South Asian Late Palaeolithic industries is heavily influenced by changing trends in Palaeolithic systematics and nomenclature, with those industries discussed here as Late Palaeolithic (following James & Petraglia, 2005) having previously been referred to by many different names. Following the diversification of named Palaeolithic industries in South Asia during the first half of the 20th century, Sankalia (1964) introduced the use of an African naming system, differentiating Early, Middle and Later Stone

Age stone tool assemblages, with the latter corresponding to assemblages referred to today as Late Palaeolithic and Mesolithic. During the 1970's, in the context of debate regarding the origins of modern humans, V. N. Misra (in Agrawal and Ghosh, 1973) proposed the use of European Palaeolithic nomenclature. In particular, he suggested that a discrete Upper Palaeolithic industry analogous to the burgeoning record of western Europe should be apparent in South Asia, corresponding with the appearance of *Homo sapiens*. Many Upper Palaeolithic sites have been reported (e.g. Murty, 1979), but from the late 1980's onwards it has become increasing apparent that these South Asian industries do not parallel developments in Europe. Rather, sites such as Patne (Sali, 1989) illustrate that Middle Palaeolithic industries are followed directly by those focusing on microlith production, without a discrete, intermediary stage. Numerous recent discoveries support the Late Pleistocene antiquity of microlithic industries (Basak et al., 2014; Clarkson et al., 2009; Mishra et al., 2013; Roberts et al., 2015), which directly follow Middle Palaeolithic industries (Clarkson et al., 2012; 2017; Petraglia et al., 2012). Comparability between Late Pleistocene and Holocene microlithic technologies suggests the division of Late Palaeolithic and Mesolithic represents chronological, rather than technological differences.

The result of this history of research is a number 'Upper' Palaeolithic assemblages offer key insight into patterns of cultural change across South Asia's diverse regions that may not neatly fit within contemporary Palaeolithic systematics. This is particularly pertinent for understanding the nature of transition between Middle and Late Palaeolithic technologies, which 'Upper' Palaeolithic assemblages once bridged. New appraisal of 'Upper' Palaeolithic assemblages may therefore help inform debate regarding the factors that promoted technological innovations and the nature of the appearance of new forms of stone tool production. Recent studies have appraised Late Palaeolithic assemblages from Sri Lanka (Lewis, 2015; Roberts et al., 2016), south India (Clarkson et al., 2012), central India (James, 2011; Mishra et al., 2013), northern India (Clarkson et al., 2017), and eastern India (Basak et al., 2014; Basak and Srivastava 2017). The overarching aim of this study is to re-evaluate the key 'Upper' Palaeolithic locality from western India, Buddha Pushkar, to offer a new, technological appraisal of behavioural diversity in this region, and establish its place in contemporary understanding of Late Pleistocene cultural change in South Asia.

2) Background

Prior to the recognition of the widespread Late Pleistocene antiquity of microlithic technologies (i.e. Late Palaeolithic), Misra (2001) indicated that although 'Upper' Palaeolithic evidence is well documented in the northern Vindhyas range (Jayswal, 1989; Sharma, 1980; Sharma and Clark, 1983), the Chota Nagpur Plateau (Ghosh, 1970), upland Maharashtra (Sali, 1989), Orissa and the Eastern Ghats (Murty, 1968; 1981; Nanda, 1984; Raju, 1988), few sites are known in western India. Such scarcity confirmed expectations that the Upper Palaeolithic timeframe matched with a period of arid climates and sparse vegetation over the Last Glacial Maximum in this region. This scarcity of 'Upper' Palaeolithic sites has been further exacerbated as the only excavated 'Upper' Palaeolithic assemblage reported from western India,16R Dune, is best described as Middle Palaeolithic and is more securely dated to 40-80ka, rather than 26ka (Blinkhorn, 2013). Except for rare Late Palaeolithic artefacts noted to occur at Katoati dating to ~21ka (Blinkhorn et al. 2015a), western India lacks Late or 'Upper' Palaeolithic assemblages dating to the Late Pleistocene.

Between 1969 and 1976 an international and interdisciplinary expedition in the Thar Desert of western India and south-eastern Pakistan aimed to investigate patterns of human behaviour in these more arid landscapes during phases of significantly different environmental conditions. The team comprised Bridget Allchin, an archaeologist from the University of Cambridge, Andrew Goudie, a physical geographer from the University of Oxford, and Karunakara Hegde, a chemist turned archaeologist from the Maharaja Sayajirao University (MSU), Baroda. This ambitious project integrated archaeological reconnaissance across a huge region into a scheme of geomorphological and palaeoenvironmental change, before the widespread application of chronometric dating (Allchin et al 1978), with a number of their conclusions borne out by more recent studies across the region. Here, focus is placed on the sites reported from the Pushkar Valley, which were a focal point of research in the 1970's because "it is so exceptionally rich in both archaeological and geomorphic evidence" (Allchin et al. 1978: 114). Critically, large collections of artefacts from Buddha Pushkar are preserved in the Department of Archaeology and Ancient History, MSU Baroda, enabling new analyses from a rare example of an Upper Palaeolithic site in western India. Below, details of the geographic and palaeoenvironmental setting, and archaeological context of the sites are set out.

2.1) Regional Geography and Palaeoenvironments

A number of significant geographic, climatic and ecological boundaries appear to occur within close proximity to the Thar Desert. Subduction of the Indian tectonic plate under the Eurasian plate and the resulting orogeny marks the western extent of the Thar Desert with dramatic increase in relief in contrast to the regions low lying, alluvial plains. The eastern extent is similarly bounded by the Aravalli Range, the subcontinent's oldest mountain chain which marks the main watershed between the south flowing drainages now dominated by the Indus to the west, and the east flowing drainages that dominate central India and feed into the Ganges. A distinct geological boundary is also evident as a result of the region's tectonic history, with different suites of geological resources present on either side of the Thar Desert. The Indian Summer Monsoon (ISM) is the dominant climatic feature of the Indian subcontinent and a sharp longitudinal gradient of precipitation is present at the eastern edge of the Thar. Dramatic differences in ecology that have resulted from the distinct climatic conditions have led to a major divide in biogeography, between the Saharo-Arabian and Oriental zones, broadly corresponding to the location of the Thar Desert (Holt et al., 2013). As a result of these major overlapping changes in geography, the margins of the Thar Desert are significant locations to examine patterns of past behavioural adaptation.

The significance of the Thar Desert to understanding Palaeolithic behaviour is amplified by the high levels of palaeoenvironmental dynamism evident in the region, such as through the presence of sand dunes far beyond the modern arid zone (Allchin et al., 1978). Patterns of palaeoenvironmental change in the region are intimately tied to the waxing and waning intensity of the ISM, which is itself controlled by orbital scale influences on patterns of polar glaciation, insolation and trans-equatorial atmospheric and ocean currents. Focusing upon the latter half of the Upper Pleistocene, a period of enhanced humidity is evident between 60-40ka in off-shore climate archives (e.g. Clemens & Prell, 2003), which is attested to by the presence of widespread fluvial activity in the regional terrestrial records (Andrews et al., 1998; Chawla et al., 1992; Dhir et al., 2010; Singhvi et al., 2010). After 40ka, fluvial deposition becomes more limited or replaced by pedogenesis of overbank deposits towards the south, whereas in the north aeolian deposition becomes more commonplace (Jain et al., 2005; Juyal et al., 2006), commensurate with decreased ISM intensity evident in off-shore records. During the first half of MIS 2 fluvial deposition is replaced by dune formations well beyond the modern limits of the arid zone, whereas significant palaeoenvironmental flux between fluvial and aeolian depositional regimes is evident after the LGM (Jain et al., 2005; Juyal et al., 2006). Although similar patterns in palaeoenvironmental change are echoed across the Indian subcontinent, the extremes between humidity and aridity are most pronounced in the margins of the Thar Desert, making it an important region to evaluate adaptation to palaeoenvironmental variability amongst Palaeolithic populations.

The Pushkar Valley is narrow and steep sided, located on the eastern edge of the Thar Desert in an important pass through the Aravalli Range. As a result, the Pushkar Valley is placed on a key east-west route of migration and communication between western and central India. Outflow from the Pushkar Valley forms one of the upper tributaries of the Luni River, the only major extant fluvial feature present in Rajasthan draining much of the western side of the Aravalli's. The presence of perennial springs in the valley, leading to the occurrence of fresh water lakes that do not dry up between wet seasons, adds to the significance of the location for prehistoric and later populations alike, and stands in contrast to the salt lakes found elsewhere in the Thar. Beyond water resources (and the floral and faunal populations that they support), the immediate environs of the valley provide a ready supply of geological materials that are suitable for stone tool production, most notably quartzite and quartz. Combined, these factors make the Pushkar Valley a strategic location for Palaeolithic occupation, and although peak aridity could have resulted in depopulation of the region, the resources available make the Pushkar Valley an ideal staging post for recolonization of the Thar Desert with the resumption of more humid conditions.

2.2) Pushkar Valley Sites

During the 1970's expedition, geomorphological study was undertaken to capture variability throughout the Pushkar valley (Figure 2a), whereas archaeological research concentrated upon a string of small perennial and seasonal lake basins, with particular focus at Buddha

Pushkar and Hokra. Survey for Palaeolithic sites concentrated on the top of dunes to the south of the lake at Buddha Pushkar, with small quantities of Medieval and Early Historic ceramics located to the north, near to the modern village of Kanas. Sites were labelled A, B, C, D, E, E/F, F, G and H. Primary artefact collection was non-selective, with all lithics recovered from measured squares, supplemented by additional recovery of larger diagnostic artefacts where collections were otherwise dominated by small flaking debris. Although problems with surface assemblages were noted, the broad differences in character between the lithic artefacts from sites A-D and E-G suggested that contamination was limited. A composite stratigraphy that summarises the variability of sediments in the Pushkar Valley and their relationship to the sites has been presented (Figure 2a)(Allchin et al., 1978; Allchin and Goudie, 1974).

In all instances, artefact assemblages were found on top of distinct sediment units, rather than occurring buried within aeolian sediments. Although deflation onto erosion resistant surfaces cannot be ruled out, the absence of buried artefacts makes it more probable that prehistoric populations were occupying sites between rather than during phases of dune formation. Sites A-D were located on the crest of modern sand dunes where it was unbroken by gullying, and unlikely to be contaminated by mixing other than by deflation. Dating of aeolian deposits at Buddha Pushkar B (Figure 2b) suggests a maximum age for these sites of 16±2.5 ka (Singhvi et al., 1994).

Sites E-G were considered to have recently been exposed as a result of increased erosion from the use of motor vehicles on an adjacent trackway and the disintegration of a thin topsoil following a number of years of drought. These sites occur on top of a distinct sediment unit compared to sites A-D, originally referred to as a Rotlhem soil, although subsequent studies have brought this into question, instead supporting the presence of weak calcretised (and therefore alkaline) soil dating between 27-22ka (Singhvi et al., 1994), which offers a maximum age for these assemblages. It is likely that these assemblages were buried by the second phase of dune formation reported by Singhvi and colleagues (1994) commencing ca 16ka. Despite the considerable period of time since the publication of these dates, their relationship with the archaeological assemblages at Buddha Pushkar and broader relevance for debate surrounding cultural change have been overlooked until now. As a result, this study offers the first clear insight into behavioural variability in western India during MIS 2, although excavation and direct dating of stratified assemblages presents a key step to corroborate this tentative chronology.

2.3) Stone Tool Assemblages

Analysis of the stone tool assemblages undertaken by Allchin et al. (1978) was primarily conducted between the two major groups of sites: A-D and E-G. Artefacts were separated from debris and subsequently subject to typological assessment. In total, A-D yielded 1446 stone pieces, of which 672 were categorised by type, and E-G yielded 662 stone pieces, of which 540 were categorised by type (Table SI2.1). The original analysis of artefacts included a metric assessment of length, width and thickness within major types (but across raw material groups), and were presented as both average values and overall range of size encountered. Based upon the typological study, both groups of assemblages were considered blade and burin industries, with broadly comparable proportions of flake cores, core trimming flakes, composite points, and scrapers. Noted departure from this includes greater proportions of blade cores and blades in A-D, and marginally more burins in E-G. Decortification and primary reduction was argued to have occurred away from the sites.

Two key differences were noted between the assemblages. Firstly, a conspicuous difference in size between the two groups of assemblages, in spite of overlaps between their overall size ranges. This difference occurred consistently between artefact classes, as well as between artefact classes when split by raw material type. Allchin and colleagues (1978) note variability exists between sites that has likely been obscured by using average values for the groups of assemblages. Secondly, there is a different pattern of raw material use between the two assemblage groups, although both focus upon use of quartz and quartzite. All assemblages were characterised as representing short-term encampments of populations exploiting the nexus of numerous ecological and geological resources, with artefact size and raw material use the key function of change through time.

3) Buddha Pushkar Revisited: Materials and Methods

The Buddha Pushkar assemblages have been curated in the Archaeological Museum, Department of Archaeology and Ancient History, MSU Baroda. A total of 1221 artefacts are available for study, all but 2 of which were labelled with a site code that identified artefacts to individual sites or a general collection (Table 1).

BP A	BP B	BP C	BP D	BP E	BP E/F	BP F	BP G	General
88	175	278	172	98	26	67	213	101

Table 1: Count of artefacts in each site assemblage from Buddha Pushkar.

The analysis presented for Buddha Pushkar has remained one of the most detailed for an 'Upper' Palaeolithic site in South Asia. Nevertheless, theoretical and methodological approaches to the study of stone tool assemblages have change significantly since these sites were first studied, and statistical analyses have become simpler and faster. As a result, a number of questions left unresolved by Allchin and colleagues (1978), particularly focusing upon differences at a site, rather than group level, can now be addressed (Table 2).

Question	Data Group	Variables
1) Are size differences between A-D and E-G statistically significant?	All Cores, All Flakes, All Retouched	Gross Size
2) Are there differences in artefact sizes between sites?	All Cores, All Flakes, All Retouched	Gross Size
3) Are there differences in Raw Material Use between sites?	All Artefacts	Raw Material Use

4) Are there differences in core, flake and retouched sizes between raw material types?	All Cores; All Flakes; All Retouched	Gross Size
5) Are there differences in core, flake and retouched sizes of different raw materials between sites?	All Cores by raw material, All Flakes by raw material, All Retouched by raw material	Gross Size

Table 2: Framework to investigate validity of previous conclusions regarding BP assemblages

As a reductive technology the size and shape of stone tools vary significantly depending on the which stages of flaking processes are preserved, alternate reduction trajectories and the length of tool use (see Tostevin 2012). Attribute based analyses are regularly employed to examine choices made by knappers in the past at different stages of lithic reduction (Scerri 2013; Scerri et al. 2016). These include raw material procurement and primary reduction, core shaping, reduction intensity, control of flaking through platform management, flake production, blank selection and tool production. New analyses of the Buddha Pushkar assemblages are organised around questions to examine variability between these seven phases of reduction trajectories (Table 3). A typological description of the artefacts was made, according to definitions presented in Table SI1.1. A range of metric and categorical attributes were recorded for all artefacts, described in Tables SI1.2-5, in order to evaluate variability in artefact sizes, reduction intensity and technological choices. Metric attributes were measured using digital scales (to 0.1g) and callipers (to 0.01mm).

Question		Data Groups	Variables
6) Are there differences in procurement/ primary reduction practices by:	Sites?	All Cores; All Debitage	Cortex
7) Are there differences in core shaping practices by:	Raw Material?	All Cores	Axial Size and Shape; Debitage Approach (Flake or Blade); Flaking Directionality
	Sites?	Core split by raw material	
	Debitage Approach?	All Cores	Flaking Directionality
	Sites?	All Flakes	
	Flaking Directionality?	Cores by Site	Flakes by Site
8) Are there differences in the extent of core reduction by:	Raw Material?	All Cores	Scar Count; Core rotations; aberrant terminations
	Sites?	Core split by raw material	
	Flaking Directionality or Debitage Approach?	All Cores	
	Site; Raw Material or Flaking Directionality?	All Flakes	Flake Type
9) Are there differences in the platform shaping and control by:	Raw Material?	Cores	Platform Size; Platform Preparation; Platform
	Sites?	Core split by raw material	
	Debitage Approach?	All Cores	
	Debitage Approach?	Core split by raw material	

	Raw Material or Debitage Type?	All Flakes	Morphology
	Sites; Debitage Type?	Flakes split by raw material	
10) Are there differences in flake production:	Raw Material Type or Debitage Type?	All Flakes	Axial Size and Shape; Dorsal Scar Morphology; Termination Type
	Site?	Flakes split by raw material and debitage type	
	between cores and flakes by debitage approach?	Raw Material Type	Comparative size and shape
11) Are there differences in blank selection for tool production by:	Sites or Debitage Approach?	All Flake, Core and Retouched	Comparative size and shape
	Sites, Debitage Approach or Raw Material?	All RT	Axial Size and Shape; Dorsal Scar Morphology; Termination Type
12) Are there differences in patterns of tool production by:	Sites, Tool Type or Raw Material	All RT	RT Length; RT Perimeter; IoI; GIUR; Typology

Table 3: Framework to evaluate variability amongst Buddha Pushkar assemblages through different stages of reduction trajectories. Further details of variables analysed are reported in Tables SI2.2-5.

A revised typology will be presented and compared with the artefact inventories presented by Allchin and colleagues (1978) alongside an evaluation of assemblage taphonomy. However, given the nature of collections available for study, and specifically the absence of the fine artefact fraction and lack of systematic recovery by excavation, this is limited to assessing mixing rather than site formation factors. Following this, analyses of artefact attributes are used to address the twelve questions set out in Tables 3 and 4.

Shapiro-Wilks tests indicate non-normal distributions of key continuous variables, whereas sample sizes for site assemblages split by raw material at times fall below n=20. As a result, non-parametric tests that do not make distributional assumptions are used to examine continuous variables. Continuous variables were analysed at a group-wise level using Kruskal-Wallis tests, and where significant differences are identified multiple pairwise Mann-Whitney tests were conducted, with a Benjamini-Hochberg adjustment made to p-values. Categorical variables were analysed using a t-test at group-wise level, although as this assumes a normal distribution, its sole use is problematic where sample sizes are low. As a result, multiple Fishers Exact tests, for which small sample sizes are unproblematic and distributional assumptions are not relevant, with a Benjamini-Hochberg adjustment made to p-values are employed at a pairwise level. P-values of pairwise testing are reported in SI3 where group-wise analysis indicates a significant result (i.e. $p<0.05$) alongside descriptive statistics where pair-wise differences are significant.

4) Results

4.1) Assemblage Composition

Table SI2.2 presents a comparison of the basic typology of each site as reported by Allchin et al. (1978) and following renewed analysis, indicating some discrepancies. Additional cores were recorded in the present study in all assemblages except for A and E/F, and additional retouched artefacts were reported in B, C, D and E/F. Meanwhile, fewer flakes were reported in all assemblages apart from D. An overall increase in artefacts included in analysis is increased for B, C, D, but decreased for A, E, E/F and G. The increase in artefact counts likely indicates inclusion of items originally reported as 'Misc. pieces of stone', partially identifiable through the contribution of Flaked Pieces to the overall assemblage totals. Decreases in artefact counts may have resulted through curation practices. The differing proportions of cores, flakes and retouched pieces may result from the distinct methods of analysis applied, and in the absence of individual artefact numbering, these differences cannot be resolved with any further detail.

Differences also occur in the numbers of artefacts from different raw materials reported (Table SI2.3). While minor differences occur for most siliceous and quartz assemblages, substantial proportions of quartz artefacts are absent from A and E. Greater variability is observed amongst quartzite collections where E, E/F and G are presently missing substantial numbers of quartzite artefacts, whereas B and D have significantly more quartzite artefacts than originally reported. Such additions are also likely to have resulted from analysis or 'Misc. pieces of stone' and may be predominately comprised of Flaked Pieces.

Evaluation of macroscopic evidence for artefact surface weathering or arris rounding indicates that the majority of artefacts show little or no evidence of either, and no patterns of statistical difference were observed between sites. A single artefact in F was recorded as highly weathered, with small numbers of medium weathered artefacts in B (n=5), C (n=2) and D (n=3). This supports suggestions made by Allchin and colleagues (1978) that the impact of mixing in the assemblages is limited, and that they had been freshly exposed at the time of collection.

A revised typological description of the Buddha Pushkar assemblages is presented in Table 4. Overall, considerable similarity is shared with the typology presented by Allchin and colleagues (1978), with the addition of nuance within existing categories, rather than any radical departure from the previous evaluation of the assemblages. For instance, small numbers of Levallois cores, Kombewa cores and a point core are recognised amongst the 'Flake Cores', alongside single platform, bidirectional and multiplatform cores (Figure 3). While blade cores predominately show a unidirectional reduction scheme, a small number of bidirectional blade cores, and a single multi-directional blade core is recognised (Figure 4). Similarly, the presence of numerous blades, point blanks and core management flakes is corroborated in the debitage collections, along with identification of rare Levallois points (Figure 5). The use of descriptive terminology presented by Inizan and colleagues (1992) has led to a more diverse retouched typology than presented by Allchin and colleagues (1978), yet a similar combination of burins, retouched blades and the use of diverse retouch strategies to facilitate hafting of small points or barbs remains apparent.

		BP A	BP B	BP C	BP D	BP E	BP E/F	BP F	BP G
Cores	Unspecified Core	0	0	1	0	1	0	0	0
	Single Platform	3	6	4	1	4	0	2	3
	Bidirectional Core	1	0	0	1	0	0	0	3
	Multi-Platform	5	5	5	4	3	1	0	13
	Undirectional Blade Core	0	14	15	11	5	2	1	17
	Bidirectional Blade Core	0	1	3	1	0	0	1	3
	Multidirectional Blade Core	0	0	0	0	0	0	0	1
	Prepared	0	1	0	1	0	0	1	0
	Levallois Core	0	1	1	1	1	0	1	1
	Point Core	0	0	0	0	0	1	0	0
	Core on Flake	0	1	0	0	1	0	0	1
	Kombewa Core	0	0	0	0	0	0	1	0
Debitage	Flake	43	75	118	95	42	7	35	106
	Broken Flake (Siret)	0	1	0	0	0	0	2	3
	Blade	15	3	29	11	3	2	1	6
	Broken Blade	3	7	29	4	5	0	3	5
	Point	1	7	4	4	4	0	1	6
	Levallois Point	0	0	0	0	1	0	0	0
	Bidirectional Point	0	0	0	0	1	0	0	0
	Kombewa Flake	0	0	1	0	0	0	0	0
	Core Management	1	7	16	6	9	3	6	21
	Bipolar Core Management	0	0	0	0	1	0	0	0
Retouched	Retouched Flake	0	11	6	6	3	2	2	3
	Retouched Blade	1	1	2	1	1	1	0	0
	Retouched Levallois Flake	0	0	0	0	0	0	0	1
	RT Core Management Flake	0	0	0	0	0	2	0	0
	RT Kombewa Flake	0	0	0	1	0	0	0	0
	Backed	1	3	1	1	4	0	3	1
	Backed Blade	0	1	5	1	1	0	0	6
	Backed Point	0	0	0	0	0	0	0	2
	Backed Segment	0	0	0	0	0	1	0	0
	Triangle	0	0	1	0	0	0	0	0
	RT Point	2	1	3	2	1	0	0	4
	RT Burin Point	0	0	0	0	0	0	0	1
	Tanged Point	0	0	0	1	0	0	0	1
	Nosed Point	0	1	4	0	0	0	0	0
	Burin	2	0	3	5	2	1	1	2
	Burin on Blade	1	0	0	0	0	0	0	0
	Core Toe	0	0	0	2	0	0	0	0
	Denticulate	0	1	1	0	2	0	0	0
	Notch	0	0	5	0	0	1	0	0
	Nosed	0	0	0	0	1	0	0	0
	Shouldered	0	0	1	0	1	0	0	0
	Tanged	0	1	1	1	0	0	2	0

Table 4: Typology of artefacts from Buddha Pushkar resulting from new analysis.

4.2) Reassessment of artefact variability between groups A-D and E-G

P-values of pairwise testing are reported in SI3.Q1-Q5 where group-wise analysis indicates a significant result (i.e. $p<0.05$) alongside descriptive statistics where pair-wise differences are significant.

Q1 - Are size differences between A-D and E-G statistically significant?

Significant size differences occur in length, width, and thickness between cores and flakes, as well as in length for retouched tools, from the Buddha Pushkar assemblages when split into broad groupings of younger (A-D) and older (E-G) sites, with the former consistently smaller than the latter.

Q2 - Are there differences in artefact sizes between sites?

When individual sites are compared for artefact sizes, significant differences occur in artefact sizes occur within the two groups of sites while a lack of significant differences occurs between a number of sites between the two groups. A recurrent trend is that artefacts from A are smaller than those from other sites, whereas artefacts from G are consistently larger than other sites. Size differences between sites B-F are rare, with artefacts from E and E/F occasionally larger than those from C or D.

Q3 - Are there differences in Raw Material Use between sites?

Significant differences in raw material use occur between the majority of sites. Quartz artefacts comprise 89% of those from A, whereas nearly three quarters of artefacts in G are made from quartzite, setting them apart from other sites. The use of rhyolite in D is notable, and while siliceous materials form notable proportions of E/F and F, they are minimal in A, D and G. E/F is also notable for the lowest use of quartz.

Q4 - Are there differences in core, flake and retouched sizes between raw material types?

Analysis of artefact sizes across the entire collection indicates significant artefact size diversity with respect to raw material type. Evidence across core, flake and retouched artefact groups indicates that quartzite artefacts are significantly larger in all three dimensions than both quartz and siliceous artefacts. Although rarer, siliceous artefacts are significantly smaller than quartz artefacts, whereas rhyolite pieces, especially flakes, are larger than quartz and siliceous materials.

Q5 - Are there differences in core, flake and retouched sizes of different raw materials between sites?

Significant size differences are apparent between sites when artefacts are split into raw material types (Figure 6). Quartz cores from A are smaller than all other sites except for B, whereas cores from both quartz and quartzite are larger in G than B-D and E. Quartz and quartzite flakes from G are larger than those across A-D, with limited differences to sites E to

F. Differences between B-F remain limited, as are differences in retouched artefact sizes. No significant differences in siliceous artefacts were noted between the sites.

Allchin and colleagues (1978) indicated that they observed some notable diversity in artefact sizes within the two groups of sites they proposed, as well as between artefacts of different raw materials. Although this analysis provides statistical support to this assessment, further analyses of lithic assemblages from Buddha Pushkar must evaluate variability between sites, rather than groups of sites, and take into account significant variability relating to raw material use.

4.3) Analysis of reduction trajectories at Buddha Pushkar

P-values of pairwise testing are reported in SI3.Q6-Q12 where group-wise analysis indicates a significant result (i.e. $p<0.05$) alongside descriptive statistics where pair-wise differences are significant.

Q6) Are there differences in procurement/primary reduction practices?

Differences in the preservation of cortex are only apparent with respect to raw material use. Quartzite artefacts preserve more cortex than quartz artefacts, and both preserve less cortex than siliceous artefact. A single pairwise difference in cortex preservation is identified when artefacts are split by raw material type, indicating that quartzite debitage from D preserves significantly more cortex than in C.

Q7) Are there differences in core shaping practices?

Core shape dimensions between raw materials reflect patterns observed in gross artefact sizes, with quartzite cores larger than both quartz and siliceous cores across all attributes, as well as quartz cores appearing significantly larger in one of five dimensions compared to siliceous cores. Blade cores show significantly higher proportions of unidirectional flaking schemes compared to higher multidirectional flaking of flake cores, with broadly comparable levels of bidirectional flaking. Quartz cores from G are larger than those from A and B in four and three dimensions respectively, with single dimension differences between (larger) C and F compared to (smaller) A.

Flake scar directionality varies significantly between sites, indicating that multidirectional flaking was more prevalent in G compared to A, B and C, where unidirectional flaking was dominant, with the same pattern evident between D and A. In addition, a higher proportion of cores from A indicate multidirectional flaking compared to flakes, suggesting multidirectional flaking became more prominent at the end of core reduction sequences at this site.

Q8) Are there differences in the extent of core reduction?

Quartzite cores preserve significantly more scars than either quartz or siliceous cores, as well as more aberrant terminations than quartz cores. No cores from A preserved scars larger than 15mm, precluding them from pairwise comparisons by site. The only significant difference in scar count between sites indicates quartz cores from G are more heavily flaked than those from B, with no other significant relationship for scar, core rotation or aberrant termination counts evident across quartz, quartzite or siliceous cores between sites. Blade cores have more scars than flake cores as well as more aberrant terminations. Unidirectional cores have been rotated less than either bidirectional cores or multidirectional cores, while multidirectional cores have fewer aberrant terminations, compared to unidirectional cores.

Across the entire flake population, core management flakes are more commonplace in G and E/F compared to A and are more commonplace amongst quartzite flakes compared to quartz flakes. Core management flakes preserves significantly higher frequencies of multidirectional flaking surfaces in total, as well as more bidirectional than unidirectional surfaces.

Q9) Are there differences in platform shaping and control?

Core platform surface sizes vary significantly with respect to raw material, with quartzite larger than quartz and siliceous. Significant variability between sites within raw material types is only identified amongst quartz cores. Amongst quartz cores, platforms from A are narrower than those from C, E and G, while those from G are wider than those from B and C, leading to a similar pattern in platform surface areas. In addition, platforms from G are thicker than those from A. The only significant difference between flake and blade cores is platform morphology with more multiple conchoidal and dihedral platforms amongst flakes in contrast to more plain or single conchoidal platforms amongst blades. Unidirectional cores have a higher ratio of platform to flaking face surface area than either bidirectional or multidirectional cores.

Amongst flakes, significant differences in both platform dimensions occur between raw material types, with quartzite and rhyolite flakes having larger platforms than quartz flakes, which are larger than siliceous flakes. In addition, siliceous flakes show much smaller platforms in relation to flake size compared to quartz or quartzite flakes. Platform morphologies differ significantly between raw material types, with the exception of rhyolite compared to either quartz or quartzite

Blades have significantly smaller platform dimensions than all other flake types, as well as smaller platform to flake size ratios than either flakes or points. Points have wider platforms than flakes, while flakes have thinner platforms than core management flakes as well as larger ration of platform to flake surface area. A significantly larger proportion of point platforms exhibit evidence of faceting than either flakes or blades. Blades have significantly more punctiform platforms than all other flake types.

Quartz flake platform depth in A is smaller than B, D, E and G, with the latter also larger than C. Platform depth is larger in G than either A or C. Quartzite flake platform dimensions are larger in G and E/F than A, B and C, while platform dimensions in F are also smaller than those from E/F. Differences in platform depth resulting in significant differences in overall platform surface area also occur between E/F and E, and between G and F.

Q10) Are there differences in flake production?

Significant size differences are apparent between alternate raw materials, flake types and sites (Figure 7). Quartz and siliceous flakes are smaller than quartzite and rhyolite flakes in all axial dimensions. Siliceous flakes are thinner in axial proximal and medial width than quartz flakes, while rhyolite flakes have larger medial widths than quartzite flakes. Quartz flakes have more squared proximal proportions than quartzite flakes, while siliceous flakes are more elongate than quartz flakes.

Blades are smaller than other types in at least 3 dimensions, while flakes are smaller than core management flakes in all dimensions and have smaller axial length and proximal axial widths than points. Points have more squared proximal portion and tapered distal portion but are less elongate than CM flakes, while blades are more elongate than other flake types, with more squared proximal proportions than CM or flakes, and points have more tapered distal proportions than either blades or flakes.

Proportions of dorsal flake scar morphologies differ significantly between all debitage types. Blades have higher proportions of proximal flake scar patterns than other types, core management flakes showing low proportions of proximal flake scars and high levels of lateral or perpendicular flaking than flakes or points, whereas flakes show more proximal flaking and less bidirectional or weakly radial flaking than points. A high prominence of axial terminations amongst CM flakes occurs in respect to feather terminations in contrast to other flake types. Points have a higher incidence of feather terminations and fewer step terminations in contrast to blades.

Analysis of variability between sites when artefacts were split by both raw material and debitage type (e.g. quartz blades, quartzite points), only revealed significant differences amongst quartz and quartzite flakes. Amongst quartz flakes, three of four axial dimensions were smaller from A than either E or G, whereas A also has smaller proximal and medial widths than B. In addition, flakes from G show more diverse termination types than D, which are exclusively feather terminations. Amongst quartzite flakes, flakes from G are larger than either B or C in all axial dimensions, flakes from E/F are larger than those from A, B and C in axial length, proximal and medial width, while flakes from A are smaller in axial length than all sites, and smaller in axial medial width than G.

Further insight into the patterns of flake production are evident from comparing the size and shape of final flake scars from the core population with actual debitage. Comparisons of blade core scars to blade sizes within sites indicate only a single difference, indicating that scars on quartzite blade cores from G are longer than quartzite blades found at the site, resulting in a larger surface area too. This suggests discard of blade cores did not occur because the size of blade products was below a desired size threshold, with discard through other problems in flaking procedure or abandonment before exhaustion both possible alternatives. Amongst quartz flakes, flake sizes from A, B, E and G are larger than those evident on flake scars, whereas for quartzite, flakes from B, C and G were larger than scars evident on cores. This diversity may reflect the breadth of technical activity producing flakes, and the continued production of flakes significantly smaller than average offers some insight into flake preferences for utilisation.

Q11) Are there differences in blank selection for tool production?

Across all sites, debitage pieces that have been selected for retouching are larger than both the wider debitage population and final core scars. Amongst retouched pieces, artefacts from E/F are larger than those from C in maximum length, with no further differences in size identified.

Q12) Are there differences in patterns of tool production?

The only significant difference amongst retouched tools occurred at a groupwise level for absolute retouch length amongst sites, but no significant pairwise relationships were identified.

5) Discussion

5.1) Typological Diversity at Buddha Pushkar

Typological diversity at Buddha Pushkar does not support a simple split of sites between those in older and younger sedimentary contexts. Site E/F lacks some basic artefact types found in all other sites, such as single platform flake cores and point blanks, but yields the only examples of a prepared point core, or a backed segment. Site A is notable for the absence of true blade cores, distinguishing it from the remaining six sites. The remaining six sites share more in common with a mix of blade and flake production methods and diverse packages of retouched tools, but can be split on the basis of tool typology into two groups, comprised of Sites B, C and E, and Sites D, F and G. While burins occur in all but one assemblage, it is notable that they do not occur in great frequency. Beyond the 'blade and burin' assemblages, once seen as typical of 'Upper' Palaeolithic industries in South Asia, considerably typological variability can be seen at Buddha Pushkar.

The presence of diverse forms of backed artefacts, evident in all sites, is significant within the wider picture of South Asian Palaeolithic industries for attributing the Buddha Pushkar assemblages to the Late Palaeolithic. The presence of points, both as predetermined blanks and as retouched pieces, is widely apparent in the Buddha Pushkar assemblages, which is a feature also shared with other Late Palaeolithic sites such as Patne (Sali 1989) or Batadomba

Lena (Lewis et al. 2014). It is worth highlighting that although blade technologies form a core component of these industries, diverse forms of flake production remain widely evident in the Buddha Pushkar assemblages, particularly in the continuity of rare, small Levallois cores, suggesting limited continuity with Middle Palaeolithic methods. Similarly, tanged and shouldered artefacts present alternate methods of modifying artefacts for hafting that are present in regional Middle Palaeolithic assemblages, but not widely evident amongst dated Late Palaeolithic industries in South Asia.

5.2) Technological Diversity at Buddha Pushkar

Renewed analysis of the stone tool assemblages from Buddha Pushkar have been able to explicitly evaluate observations made by Allchin and colleagues (1978). In addressing Q1-Q5 it is apparent that differences between groups of sites, individual sites and raw material types noted during their original study are statistically significant. Critically, however, patterns of variability within groups of assemblages A-D and E-G, as well as significantly comparability between them, suggest they are not suitable groups for analysis, also supported by examination of variation amongst the presence and absence of types. Similarly, the answers to Q6 support previous, unquantified indication of low levels of cortical artefacts at the sites. Some differences in cortex coverage were identified by raw material type, but this does not detract from earlier suggestions that primary reduction was predominately conducted elsewhere for all assemblages.

A recurrent trend in size-based attributes was observed across multiple phases of reduction, including core shaping, platform control and flaking. Artefacts from A were typically smallest, whereas those from G were typically largest regardless of raw material type. Diversity within the remaining sites suggested artefacts from B-D were occasionally smaller than those from E to F, but without clear, recurrent trends, and often only observed in single variables from a reduction phase. As these trends occur within raw material types, the different patterns of raw material use at the sites may have been a factor of choice, with quartzite selected more frequently at G to produce larger tools, and quartz selected more frequently at A for the production of smaller tools.

The repeatedly smaller size of artefacts from A could also be a factor of reduction intensity, although the small size of cores from this site may also have obscured reduction features to support this. Instead, this is weakly supported by differences in flaking directionality between cores and flakes, suggesting a change in flaking practice immediately prior to core discard. Conversely, a range of indicators (e.g. scar counts; aberrant terminations) suggest a greater intensity of reduction of quartzite artefacts, especially those from G, despite their large size. This further supports the suggestion that raw materials were selected to enable production of tools of certain sizes, rather than size of tools produced constrained by raw material availability. Comparison of flake to scar sizes suggests at several sites quartz cores were producing smaller than average flakes at the point of discard, whereas quartzite cores were abandoned having produced larger than average flakes at some sites. Differences between sites suggests alternate preferences in stone tools sizes. This may also relate to different patterns of skill in successful reduction from different materials and clast sizes, but this is not clearly apparent at Buddha Pushkar.

Significant diversity in reduction practices are apparent between different debitage approaches, with blades, points, flakes and core management pieces distinguished across a range of features of platform control and flaking practice. This suggests that specific features of core shaping and platform control were employed for alternate debitage schemes, with impacts upon flaking outcomes. Critically, limited variability exists between blades and points between sites, suggesting aspects of continuity with regards to blank production that are not apparent from the wider debitage assemblage. Blanks selected for retouching are larger than the wider debitage assemblage or last removal evident on cores, but there is limited technological variability amongst retouched tools that differentiates between approaches to their production or between sites.

Technological variability amongst the Buddha Pushkar assemblages appears predominately driven by choices of raw material use and debitage strategy. Considerably continuity in debitage strategies is evident between sites, suggesting a comparable technological repertoire was employed by the populations that produced the assemblages. Raw material use patterns have an over-riding impact on variability amongst the assemblages, but do not appear to relate to differential access to different resources. Rather, decisions relating to raw material use may relate to the size of desired flaking outcomes, or potentially patterns of skill and the ability to successfully produce useable tools from smaller raw material clasts. While both explanations may play a role, the latter could explain changes in artefact sizes between that transcend raw material use as a factor.

5.3) Buddha Pushkar in the wider landscape

The Buddha Pushkar assemblages can best be described as Late Palaeolithic industries, all of which include the production of small flakes and blades, and use of backing as a retouch strategy. However, this detailed examination illustrates considerable technological diversity within these Late Palaeolithic industries, as well as the presence of features that are reminiscent of Middle Palaeolithic industries. Examining such diversity plays as important a role in understanding the nature of the emergence of Late Palaeolithic industries, and particularly serves to counter-balance a focus on identifying the earliest evidence of certain types, such as backed microliths. The evidence from Buddha Pushkar suggests Late Palaeolithic populations in western India had a diverse technological repertoire that enabled flexibility in using raw materials and producing tools of varying sizes.

No simple division between sites based on their sedimentary and probable chronological context is evident in this typological and technological study. As raw material choice and its impact on artefact sizes have an important impact on variability, Sites A and G appear to bracket a continuum of variability. The occupations at Buddha Pushkar span MIS 2, a period of particularly high amplitude environmental change which may have significant implications for patterns of behavioural diversity. This could reflect an adaptation to high levels of environmental flux, with technological diversity enabling population resilience in the face of changing ecologies. Alternatively, based on the geographic position of the Pushkar Valley, the diversity of stone tool technologies could relate to accessing different resource bases on either side of the Aravalli range or cultural patterns arising from population structure. However, as the assemblages derive from surface collections and potentially represent a palimpsest of behaviour, a combination of these explanations may be applicable.

A number of Middle Palaeolithic assemblages can be found dating to the first half of MIS 3 (45-60ka), including 16R Dune (Blinkhorn 2013), Chamu and Shergarh Tri-Junction (Blinkhorn 2014), Jetpur (Baskaran et al. 1986), and Katoati (Blinkhorn et al. 2017). The youngest Middle Palaeolithic site in the Thar Desert, at Shergarh Tri-Junction, dates to less than 43ka, and is notable for incorporating both Levallois and non-Levallois forms of blade production amongst other flake reduction approaches (Blinkhorn 2014), which are otherwise extremely rare in the region. The attribution of the assemblages from Buddha Pushkar to early (E-G) and late (A-D) MIS 2 fills a significant gap in the chronology of Late Pleistocene occupation of the Thar Desert, which otherwise extended into the early Holocene. Although the timegap between the youngest Middle Palaeolithic assemblages and the Late Palaeolithic sites at Buddha Pushkar prohibits clear examination of the transition between these technologies, an element of continuity can be observed in the co-occurrence of blade and prepared core reduction approaches.

The Late Palaeolithic assemblages from Buddha Pushkar present two alternate retouch strategies associated with hafting: the use of backing, and basal modifications such as tangs and shoulders. Backed artefacts are reliant upon effective use of mastics to attach stone components to a shaft, whereas the basal modifications may enable stone tips to be affixed to shafts using bindings alone (Barham 2013). The co-occurrence of these alternate strategies at Buddha Pushkar could relate to differential patterns of use, although patterns of landscape learning, resource distribution and the availability of resinous plants suitable for mastic production influenced the choice of hafting strategy. Basally modified tools have elsewhere been noted as a repetitive element of Middle Palaeolithic technologies within the Thar Desert, occurring in assemblages dating to both MIS 5 and MIS 3 (Blinkhorn et al. 2015b), whereas backed elements are absent. While this highlights another area of continuity between Middle and Late Palaeolithic technologies in the region, the appearance of basally modified pieces in the Buddha Pushkar assemblages may simply reflect a conservative behavioural approach to recolonization of the Thar Desert, augmenting the application of more advanced multi-component hafting methods.

Table 6 presents patterns of presence or absence of key artefact types for major dated Late Palaeolithic sites across South Asia. Although the appearance of microblade technology is widespread, neither it, nor any other type considered, is ubiquitous across all assemblages.

Indeed, certain types are entirely absent in some regions, exemplified by the absence of burins reported from Batadomba Lena, Sri Lanka. As wider evidence from across Asia does not support models for the appearance of Late Palaeolithic assemblages with the earliest dispersals of modern humans across South Asia, new focus needs to be placed upon examining heterogeneity within these stone tool technologies and between different regions. West India, here represented by Buddha Pushkar, is notable for the high frequency of prepared core technologies (Levallois/Discoidal), which are found in all other regions of India except for East India, but within individual assemblages. The continued use of prepared core technologies within MIS 2 is comparable with other marginal regions within close proximity to highly arid environments (e.g. Scerri et al. 2017; Osypinska and Osypinska. 2016). Further examination of the western Indian Late Palaeolithic record may focus upon the nature of such technological longevity and its relationship to population resilience and environmental flux.

Overall, close comparisons in the combinations of artefacts present occur between the sites at Buddha Pushkar, Patne and Jwalapuram, including the majority of artefact types considered, in contrast to other sites and regions where a more piecemeal appearance of these types occurs. Unlike locations such as Jwalapuram (see Petraglia et al. 2009), the Thar Desert margin is an unlikely context to have offered enduring refugia throughout major oscillations in Late Pleistocene ISM intensity. As a result, sites such as Buddha Pushkar are less likely to have been the locus of innovation of new technologies, such as microblade production, but may offer distinctly new contexts for their application. Recovery of excavated assemblages from western India are necessary to offer more detailed appraisal of the origins of Late Palaeolithic technologies in the region, and the contributions of technological conservation and the movement of populations or ideas in enabling occupation of a region of extreme environmental flux in the terminal Pleistocene.

Region	Site	Assemblage	Age	Levallois/Discoidal	Flake Core	Blade (>4cm)	Burins	Scraper/Notch	Microblades (<4cm)	Microblade Cores	Backed Artefacts
Sri Lanka	Batadomba Lena	4	12.7	-	+	-	-	+	+		+
		5	13.1	-	+	-	-	-	+	+	+
		6	13.8	-	+	-	-	-	+	+	+
		7a	19.4	-	-	-	-	+	+	+	+
		7b	22.9	-	-	-	-	-	+	+	+
		7c	30.6	-	-	-	-	-	+	-	+
South India	JWP9	B	<11	-	+	+	+	+	+	+	+
		C	20_11	-	+	+	+	+	+	+	+
		D	34	+	+	-	+	+	+	+	+
		E	>34	-	-	-	-	+	+	-	-
Eas	Mahadebbera	Unit 1	39-28	-	+	-	-	-	+	-	-

		Surface	39-28	-	-	-	+	+	+	-	+
	Kana		42	-	+	-	-	-	+	-	-
Central India	Patne	IIA	>25	+	-	-	+	+	+	+	-
		IIB	>25	+	-	-	+	+	+	+	+
		IIC	>25	-	+	-	+	+	+	+	+
		IID	>25	-	+	-	+	+	+	+	+
		IIE	25	-	+	-	+	+	+	+	+
		IIIA	<25	-	+	-	+	+	+	+	+
		IIIB	<25	-	+	-	-	-	+	+	+
		IIIC	<25	-	+	-	-	-	+	+	+
	Inamgaon		22	-	+	+	+	+	-	-	+
	Mehtakheri		44	-	-	-	-	+	+	+	+
North India	Rampur		26	-	-	+	+	+	-	-	+
	Dhaba 3	Upper	37-26	-	+	-	-	+	+	+	-
	Baghor		39-26	+	-	+	+	+	-	+	+
	Dhaba 2		42-26	-	-	-	-	-	+	-	-
	Dhaba 3	Lower	55-47	-	+	+	+	-	+	+	-
West India	Buddha Pushkar	A	<16	-	+	-	+	-	+	-	+
		B	<16	+	+	-	-	+	+	+	+
		C	<16	+	+	-	+	+	+	+	+
		D	<16	+	+	-	+	+	+	+	+
		E	27-16	+	+	-	+	+	+	+	+
		E_F	27-16	-	+	-	+	+	+	+	+
		F	27-16	+	+	-	+	+	+	+	+
		G	27-16	+	+	-	+	+	+	+	+

Table 6: Presence (+) and absence (-) of key artefact types across Late Palaeolithic assemblages across different regions within South Asia, synthesised from Perera et al. 2011; Clarkson et al. 2009; Basak et al. 2014; Sali 1989; Mishra et al. 2013; Clarkson et al. 2017.

6. Conclusion

Debate surrounding the origins of Late Palaeolithic technologies in South Asia is moving away from simplistic models associated with the dispersal of the earliest modern human populations. As a result, research focus must mature from identifying the earliest evidence of Late Palaeolithic technology as a simple index of human dispersal to explore behavioural diversity within Late Palaeolithic assemblages within the context of striking regional variability in ecology and the influence of climatic changes across MIS 3 and 2. The re-examination of the classic site of Buddha Pushkar presented here contributes to this goal by illustrating patterns of technological variability within early and later stages of MIS 2, offering the first clear insight into Late Palaeolithic behavioural strategies in western India. This detailed study has illustrated patterns of variability that transcend the binary division of sites originally presented by Allchin and colleagues (1978), highlighting changing preferences for raw material use and it influence upon artefact size while drawing from shared approaches to manufacture of alternate flake blank forms. Controlled recovery and chronometric studies are required to better integrate evidence from western India into a wider picture of the origin and evolution of Late Palaeolithic technologies across South Asia, as well as what, if any, technological changes differentiate them from regional manifestations of Mesolithic technologies. Nevertheless, evidence from Buddha Pushkar is consistent with the mosaic expression of Late Palaeolithic technology observed elsewhere in South Asia. Critically, the continued presence of technological features typically associated with Middle Palaeolithic assemblages may point towards conservative approaches to occupation of marginal landscapes during the adoption of new methods of stone tool production.

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Figure Captions:

Figure 1: Map illustrating the distribution of Late Palaeolithic sites dating between ~45 to 11.5 thousand years ago (blue circles) and the location of Buddha Pushkar (red star) within its topographic (left)(Jarvis et al. 2008) and ecological (right)(Olsen et al. 2001) context.

Figure 2: (A) Composite stratigraphy of sediment deposits and their archaeological associations throughout the Pushkar Valley (modified from Allchin et al. 1978); (B) dated section within vicinity of Buddha Pushkar B indicating landforms associated with Late Palaeolithic stone tool assemblages across the valley (modified from Singhvi et al. 1994).

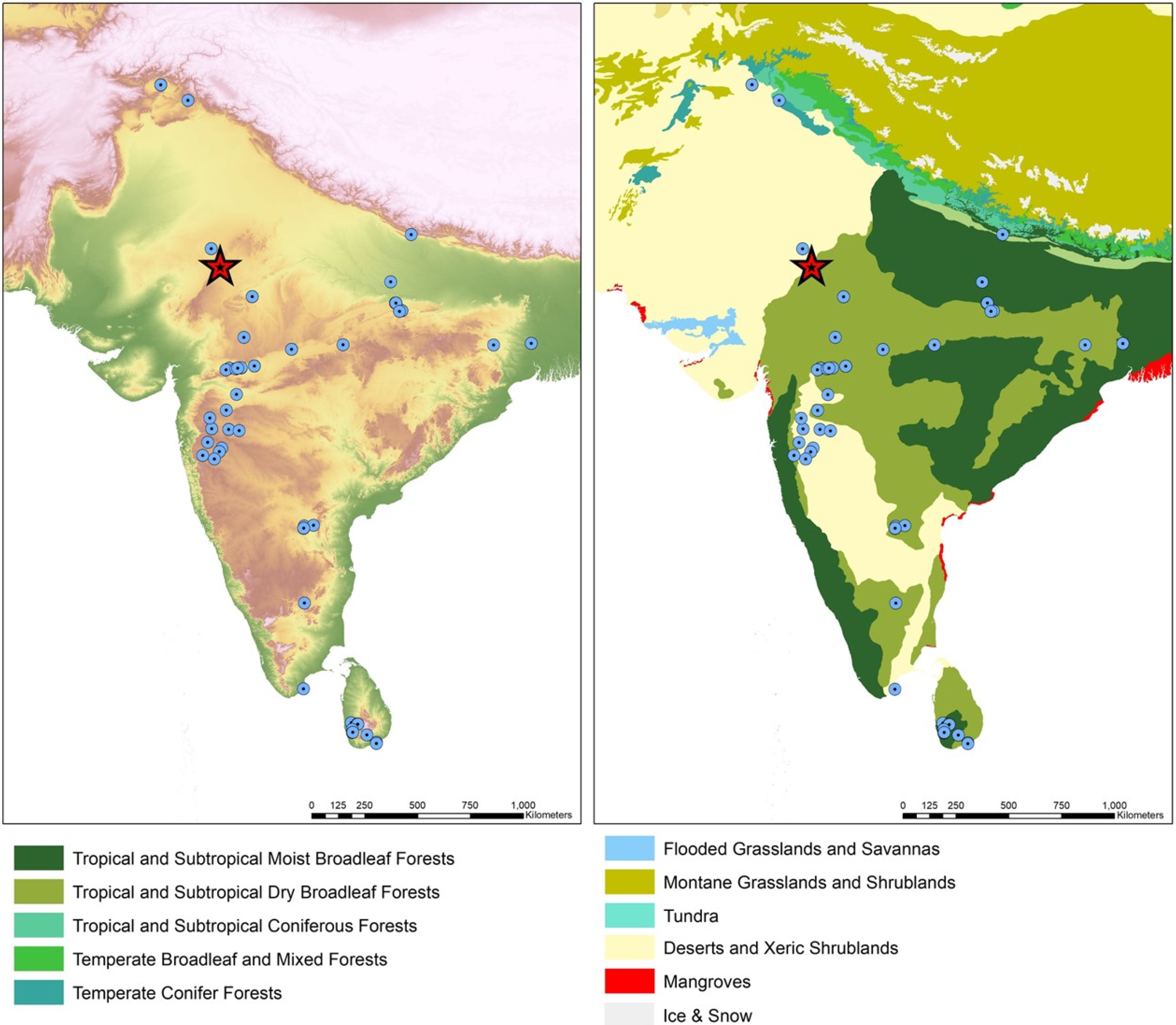
Figure 3: Examples of flake cores including (two single platform quartz flake cores (A, B); a quartzite prepared core (C); a quartzite single platform core (D); and a quartzite Levallois core (E).

Figure 4: Examples of blades cores in quartz (A) and quartzite (B-D).

Figure 5: Examples of debitage, including: blades produced on a range of quartz, quartzite, rhyolite and siliceous material (A-I); rhyolite (J), quartzite (K) and quartz (L) points; elongate quartz flake (M); radial quartzite flake (N); convergent quartzite flake (O); quartz flake (P); quartzite Levallois flake (Q); quartzite blade (R).

Figure 6: Maximum dimension (mm) of cores, flakes and retouched pieces split between raw material types and sites, illustrating the key role raw material choice plays on artefact sizes, followed by differences between sites.

Figure 7: Maximum dimension (mm) of alternate flake types, split by raw material type and sites, illustrating the major trends in variability of flake production at Buddha Pushkar.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Tropical and Subtropical Moist Broadleaf Forests
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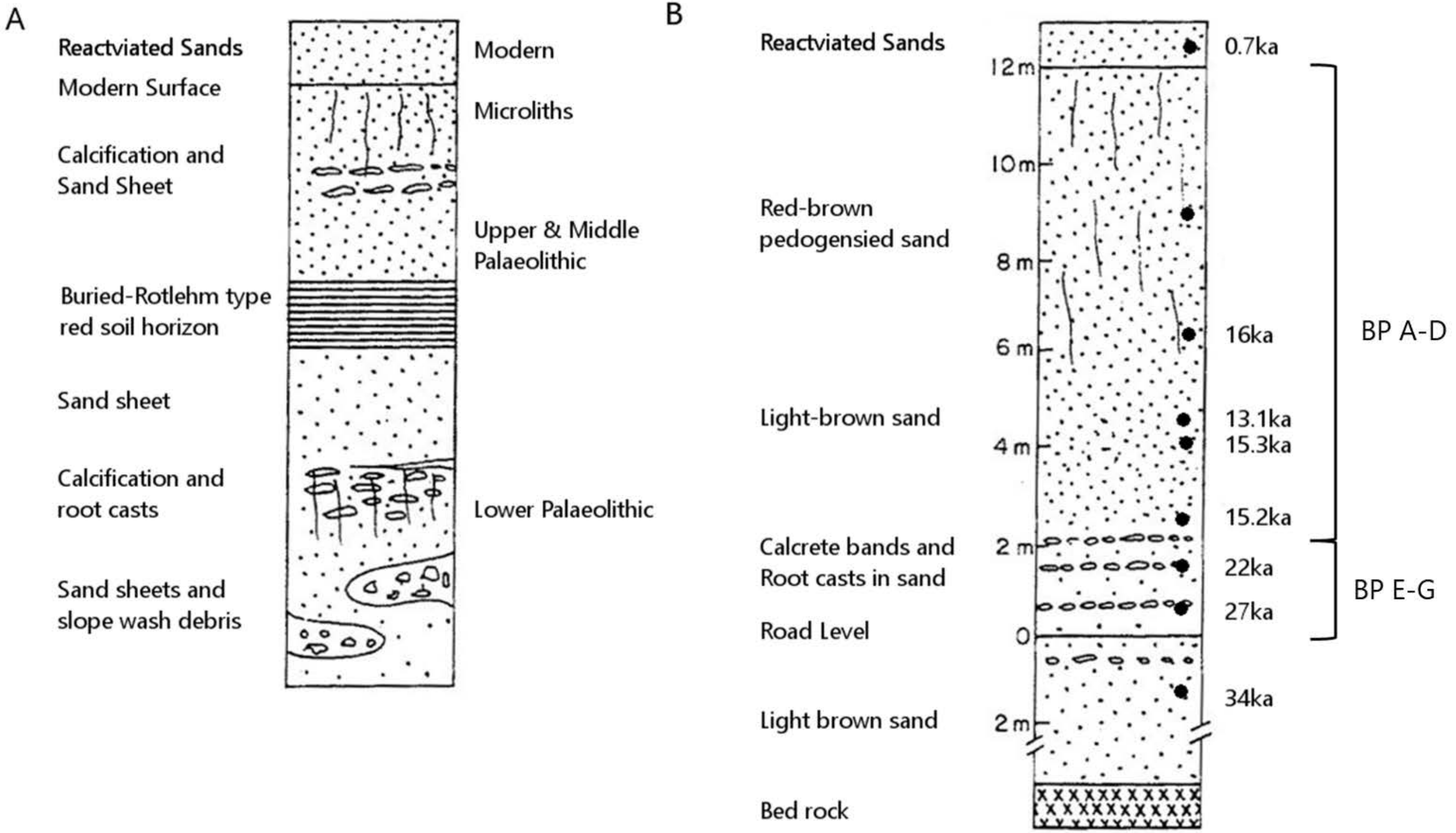
Tropical and Subtropical Coniferous Forests
Temperate Broadleaf and Mixed Forests
Temperate Conifer Forests
Flooded Grasslands and Savannas
Montane Grasslands and Shrublands
Tundra
Deserts and Xeric Shrublands
Mangroves
Ice & Snow


A
Reactviated Sands
Modern Surface
Calcification and Sand Sheet
Buried-Rotlehm type red soil horizon
Sand sheet
Calcification and root casts
Sand sheets and slope wash debris
Modern
Microliths
Upper & Middle Palaeolithic
Lower Palaeolithic
B
Reactviated Sands
Red-brown pedogensied sand
Light-brown sand
Calcrete bands and Root casts in sand
Road Level
Light brown sand
Bed rock
12 m
10 m
8 m
6 m
4 m
2 m
0
2 m
0.7ka
16ka
13.1ka
15.3ka
15.2ka
22ka
27ka
34ka
BP A-D
BP E-G


METRIC 1 2 3 4 5 6 7 8 9 10
A
B
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A
B
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METRIC 1 2 3 4 5 6 7 8 9 10


A
B
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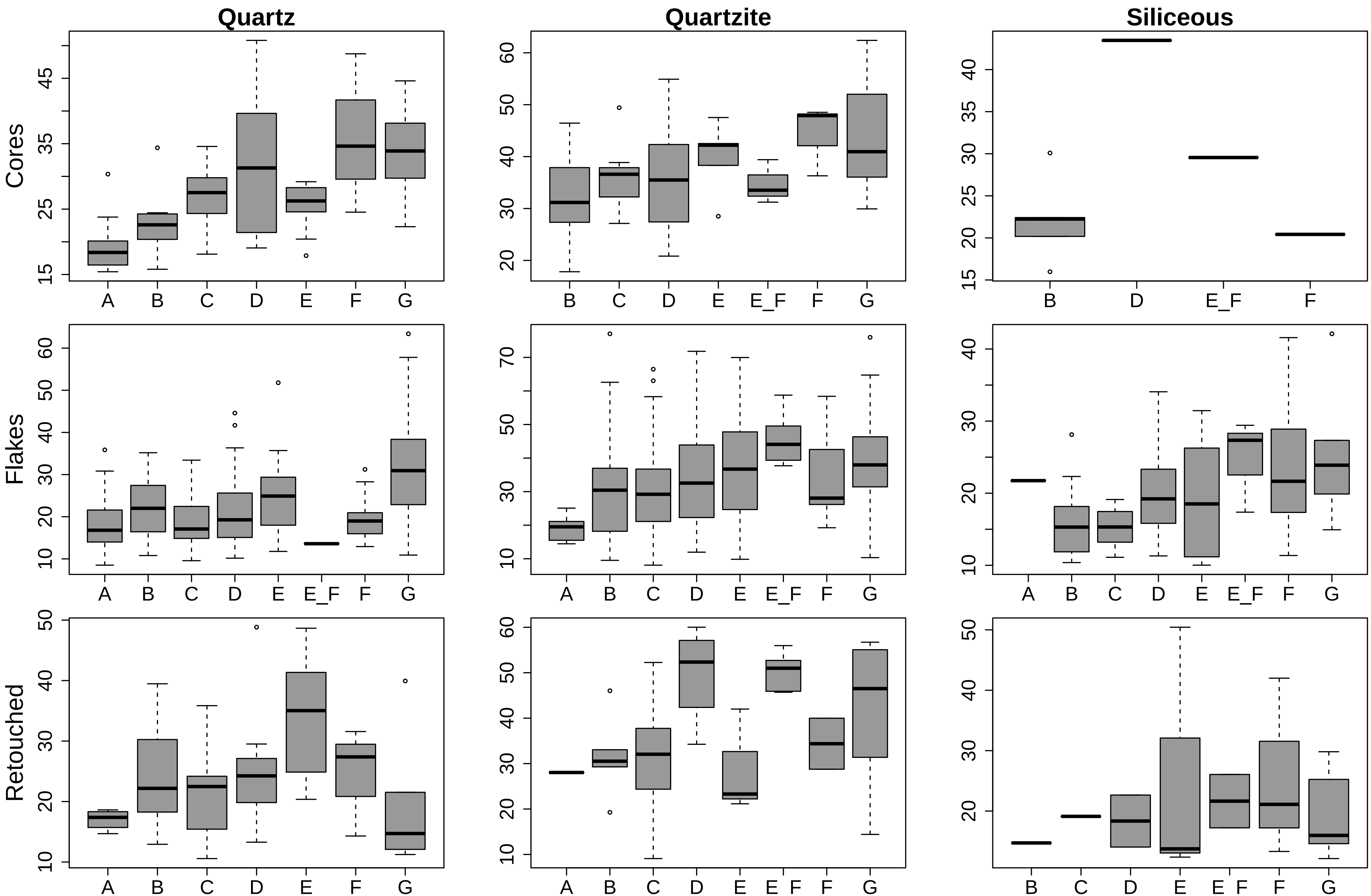
METRIC 1 2 3 4 5 6 7 8 9 10


Quartz
Quartzite
Siliceous
Cores
Flakes
Retouched
A
B
C
D
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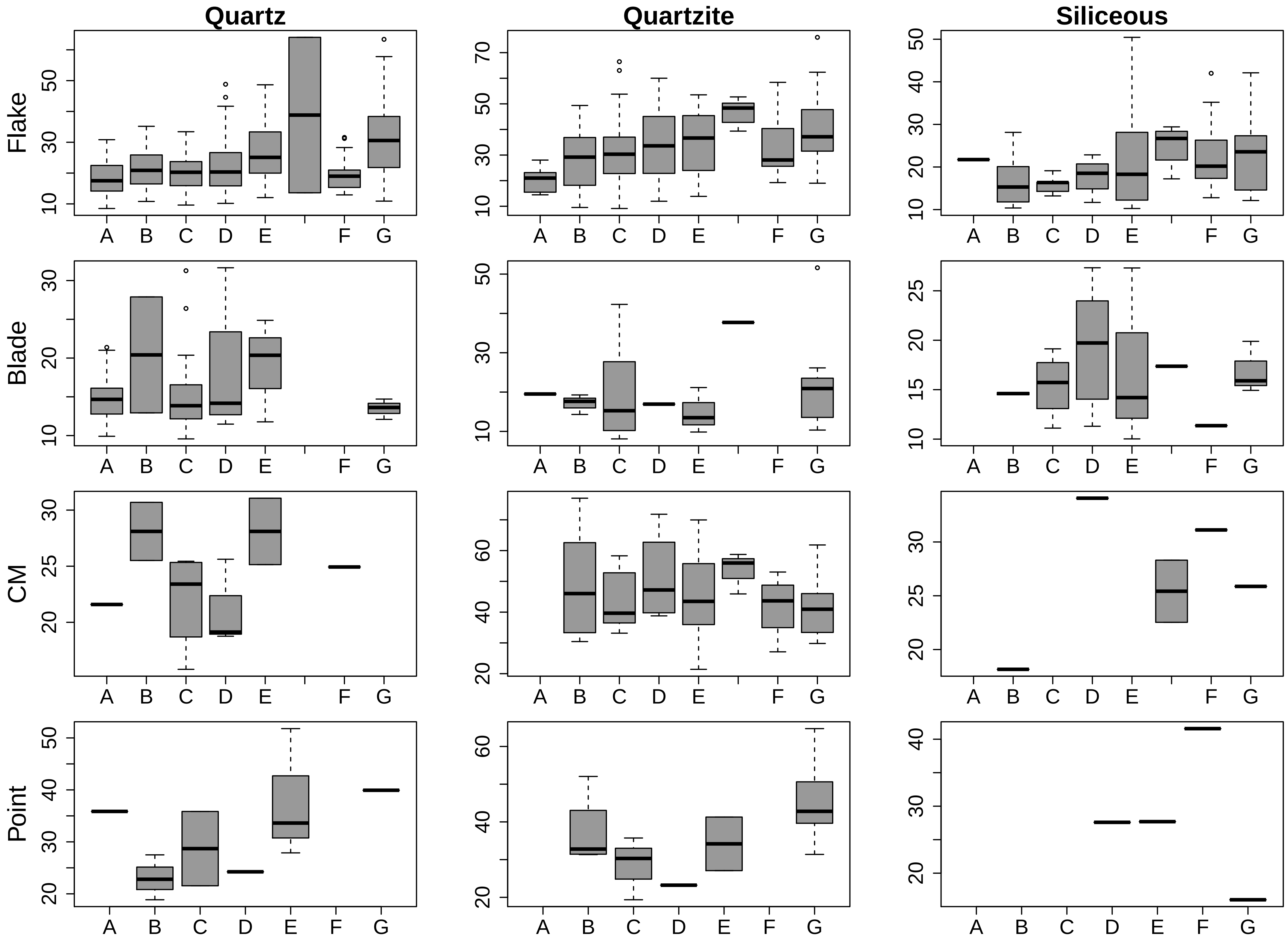
E_F
F
G



Quartz
Quartzite
Siliceous
Flake
Blade
CM
Point
A B C D E F G

Table SI1.1: Description of artefact typology

Group	Type	Description
Core	Single Platform Core	A core exploited from a single platform without distinct shaping of the flaking surface
	Multi-Platform Core	A core exploited from more than one platform without distinct shaping of the flaking surface
	Unidirectional Blade Core	Core exploited in a single direction that has been shaped to produce elongate flake blanks
	Bidirectional Blade Core	Core with flaking surface shaped to produce elongate banks exploited from opposing platforms
	Bipolar core	A core that has been struck while rested against an anvil
	Levallois Core	A core with volumetric hierarchy between flaking and platform surfaces, and prepared flaking surface to remove flakes of predetermined shape
	Prepared Core	A core with distinct, shaped flaking and platform surfaces that fit some but not all criteria of Levallois cores
Flake	Flake	A blank removed from a core with distinct ventral, dorsal and platform surfaces
	Blade	Elongate flake at least twice as long as broad with at least one longitudinal arise
	Point	Convergent flake with symmetry on morphological or flaking axis
	Core Management Flake	A flake that has a prior flaking platform on the dorsal surface, or has removed an aberrant termination from a flaking surface paired with an axial or overshot termination.
Flaked Piece	Flaked Piece	Flaking debris that cannot be classified as either a flake or core
Retouched	Burin	A tool where a burin spall has been removed obliquely from the edge of a flake
	Backed Piece	A tool with steep, blunting retouch on an edge
	Point	A tool retouched on one on more edge to produce a convergent outline
	Triangle	A blade segment with one edge blunted into two edges to form a triangle
	Denticulate	A tool with a series of adjacent small notches
	Notch	A tool with a single or multiple retouch removals producing a distinct convexity on the flake edge
	Scraper	A tool with a contiguous section of retouch

Table SI1.2: Description of attributes recorded on all artefacts and their group for analysis

Attribute	Method	Details
Weathering	Ranked assessment of surface macroscopic weathering (None, Low, Medium, High)	
Rounding	Ranked assessment of macroscopic arise rounding (None, Low, Medium, High)	
Raw Material Type	Quartz (Crystal or Milky), Siliceous (Chert, Chalcedony), Quartzite	
Raw Material Colour	Recorded in 3 components: shade (Light, Mid, Dark); qualifier (minor colour); colour (major colour)	
Cortex %	Percentage cortex coverage in 10% increments	Cortex
Cortex Surface Area	Cortex% * Surface Area	Cortex
Basic Type	Typology to determine attributes to record; Core, Flake or Flaked Piece (lacking diagnostic features to differentiate as either core or flake)	
Broken	Yes or No	
Weight	g	
Maximum Length	Measurement of maximum artefact length	Gross size
Maximum Width	Largest measurement perpendicular to maximum length	Gross size
Maximum Thickness	Largest measurement perpendicular to plane of maximum length & width	Gross size
Surface Area	Max. Length * Max. Width	Gross size

Table S1: Attributes recorded on all artefacts

Table SI1.3: Description of attributes recorded on all cores and their group for analysis

Attribute	Method	Details
Core Type	Single Platform, Multi Platform, Blade, Levallois, Prepared (delineation/hierarchy of flaking and platform surfaces but not meeting criteria for Levallois)	
Axial Length	Length along flaking axis of last major (>15mm) removal	Axial Size
Axial Proximal Width	Width perpendicular to flaking axis at ¼ of axial length	Axial Size
Axial Medial Width	Width perpendicular to flaking axis at ½ of axial length	Axial Size
Axial Distal Width	Width perpendicular to flaking axis at ¾ of axial length	Axial Size
Proximal Shape	APW / AMW (Index of shape indicating narrowing (>1), parallel (1) or expanding (<1) edges along flaking axis)	Axial Shape
Distal Shape	AMW / ADW (Index of shape indicating narrowing (>1), parallel (1) or expanding (<1) edges along flaking axis)	Axial Shape
Medial Axial Thickness	Thickness at ½ axial length, perpendicular to plane of flaking	Axial Size
Platform Width	Total width of platform surface perpendicular to flaking plane	Platform Size
Platform Depth	Depth of platform surface from point of percussion of last major (>15mm) removal	Platform Size
Platform Surface Area	PW * PD	Platform Size
Size Corrected Platform Area	PSA / SA	Platform Size

Platform Type	Cortical, Plain (no clear scar), Single Scar, Dihedral, Multiple Scar, Crushed, Punctiform	
Platform Preparation	Overhang Removal, Facetting, Both, Neither	
Core cortex location	Platform, flaking surface, side, distal, rear surface, NA	
Scar count (>15mm)	Count using digital calipers to assess scar sizes	
Core Rotations	Count of minimum number of times core was rotated to produce scar pattern (e.g. a core flaked from a single, unprepared platform has not been rotated [0], a core flaked from two, separate unprepared platforms has been rotated once [1])	
Aberrant Terminations	Count of the number of step or hinge terminations present on core	
Last Scar Face Length	Length of last flaking face on flaking axis	Last Scar Size
Last Scar Length	Axial length of last scar (>15mm)	Last Scar Size; Comparative Size
Last Scar Medial Width	Width of last scar perpendicular to flaking axis at ½ axial length	Last Scar Size; Comparative Size
Last Scar Elongation	LSL / LSMW	Last Scar Shape; Comparative Shape
Last Scar Surface Area	LSL * LSMW	Last Scar Size; Comparative Size

Table SI1.4: Description of attributes recorded on all flakes and their group for analysis

Attribute	Method	Details
Flake Type	Flake, Blade, Core Management, Point	
Axial Length	Length along flaking axis	Axial Size; Comparative Size
Axial Proximal Width	Width perpendicular to flaking axis at ¼ of axial length	Axial Size
Axial Medial Width	Width perpendicular to flaking axis at ½ of axial length	Axial Size; Comparative Size
Axial Distal Width	Width perpendicular to flaking axis at ¾ of axial length	Axial Size
Proximal Shape	APW / AMW (Index of shape indicating narrowing (>1), parallel (1) or expanding (<1) edges along flaking axis)	Axial Shape
Distal Shape	AMW / ADW (Index of shape indicating narrowing (>1), parallel (1) or expanding (<1) edges along flaking axis)	Axial Shape
Medial Axial Thickness	Thickness at ½ axial length, perpendicular to plane of flaking	Axial Size
Elongation	AL / AMW	Axial Shape; Comparative Shape
Platform Width	Total width of platform surface perpendicular to flaking plane	Platform Size
Platform Depth	Depth of platform surface from point of percussion	Platform Size
Platform Surface Area	PW * PD	Platform Size
Size Corrected Platform Area	PSA / SA	Platform Size
Platform Type	Cortical, Plain (no clear scar), Single Scar, Dihedral, Multiple Scar, Crushed, Punctiform	

Platform Preparation	Overhang Removal, Facetting, Both, Neither	
Platform on Dorsal Surface	Yes or No	
Dorsal Scar Pattern	Proximal, Distal, Lateral, Bidirectional (Proximal & Distal), Bilateral (Left and Right), Perpendicular (combination of Proximal or Distal, and Left or Right), Weakly Radial (from 3 directions), Radial (from 4+ directions	
Termination Type	Feather, Hinge, Step, Outrepasse, Axial	
Retouched?	Yes or No	
Scar Count	Count of scars >15mm on dorsal surface	
Aberrant Terminations	Count of aberrant terminations on dorsal surface	
Longitudinal Arises	Count of arises aligned on flaking axis extending for more than 1/3 of axial length	
Erralieur Scar	Present, absent	
Lipped/Diffuse initiation	Yes or no (i.e. no lipped/diffuse initiation indicates a clear bulb of percussion is present)	

Table SI1.5: Description of attributes recorded on retouched artefacts

Attribute	Method	Details
Backing	Present or absent	Backing is identified as short, consecutive retouch removals that blunt an edge of a flake
Burin	Present or absent	A burin spall has been removed obliquely from the flake edge
Burin Spall Count	Count of burin spall removals	
Retouch delineation type	Straight, convex, concave, denticulate, notch, nose, shoulder, tang	Following
Retouch Length	Total perimeter of retouching	
Geometric Index of Unifacial Reduction (GIUR)	Thickness of retouching from ventral face onto dorsal surface / thickness of ventral face to dorsal surface	Index of the extent to which retouch has invaded flake thickness
Index of Invasiveness (IoI)	Each flake surface is split into 8 marginal and 8 invasive sectors (Proximal, Proximal Right/Left, Medial Right/Left, Distal Right/Left, Distal) and the presence/absence of retouch recorded. A unifacial IoI is calculated as total retouched sectors / 16 or a bifacial IOI as total retouched sectors / 32	
Type		

Table SI2.1: Artefact typology from A-D and E-G as reported by Allchin and colleagues (1978), showing the percentage of artefact type split between raw materials, and the percentage of total artefact type for the entire assemblage.

Assemblage	A-D					E-G				
Raw Material	Quartz	Quartzite	Chalcedony	Total	%	Quartz	Quartzite	Chalcedony	Total	%
Flake Cores	3	4		7	1.0		10		10	1.9
Blade Cores	19	27	6	52	7.7	6	22	4	32	5.9
Blade Core Rough Out		5		5	0.7	4	5		9	1.7
Blade Core Fragments	6			6	0.9	6	3		9	1.7
Longitudinal blade core-trimming flakes	16	19		35	5.2	3	25		28	5.2
Core tablets	1	2		3	0.5		16		16	3.0
Core toes	1	5	2	8	1.2		20	1	21	3.9
Blades	15	6	4	25	3.7	7	9		16	3.0
Retouched Blades and fragments	3		2	5	0.7			1	1	0.2
Blade Fragments	53	35	14	102	15.2	11	16	7	34	6.3
Composite points and barbs	8	1	4	13	1.9	4	1	6	11	2.0
Concavo-convex scrapers	5			5	0.7	3	4		7	1.3
Carinated scrapers	4	6		10	1.5	2	7		9	1.7
Burins	14	3		17	2.5	10	8		18	3.3
Burin spalls	2			2	0.3	4			4	0.7
Flakes from prepared cores	76	98	8	182	27.1	54	138	8	200	37.0
Pointed flakes	1	4	2	7	1.0	4	10		14	2.6
Other flakes	124	46	13	183	27.2	16	73	2	91	16.9
Adze blades	4			4	0.6	3	3		6	1.1
Chopping tools	1			1	0.2					
Awls								2	2	0.4
Saws						1	1		2	0.4
Total	356	261	55	672	100	138	371	31	540	100

Table SI2.2: Differences between key artefact types reported by Allchin et al (1978) and recorded following renewed analysis within individual sites.

	Present Study							
	Core	Diff	Flake	Diff	RT	Diff	Flaked Piece	Total Difference
BP_A	9	-8	63	-24	7	-6	9	-29
BP_B	29	13	100	-3	20	2	26	38
BP_C	29	5	197	-42	33	23	20	6
BP_D	20	7	122	2	19	8	11	28
BP_E	15	3	66	-53	16	-2	2	-50

BP_E-F	4	-2	12	-16	8	1	2	-15
BP_F	7	3	48	-4	8	-3	4	0
BP_G	42	4	147	-78	21	-11	2	-83

Table SI2.3: Differences between raw material use within individual sites as reported by Allchin et al. (1978) and following renewed analysis.

	Quartz	Difference	Quartzite	Difference	Rhyolite	Siliceous	Difference
BP_A	78	-27	9	+1		1	-3
BP_B	74	+9	84	+25		17	+4
BP_C	112	+3	153	-1		14	+4
BP_D	80	+3	61	+21	7	23	-5
BP_E	48	-18	39	-35		12	+3
BP_E-F	2	-1	16	-19		8	+5
BP_F	26	+2	24	-5		17	+4
BP_G	45	0	154	-66	1	12	+5

				E-G			
Variable			p	Min.	1st Qu.	Median	Mean
Core Max Length	A-D	E-G	0.00	17.88	29.68	36.05	37.52
Core Max Width	A-D	E-G	0.00	14.96	25.02	30.34	30.8
Core Max Thickness	A-D	E-G	0.01	3.82	15.15	20.25	20.15
Flake Max Length	A-D	E-G	0.00	9.84	23.61	31.68	33.06
Flake Max Width	A-D	E-G	0.00	4.45	17.03	23.24	23.7
Flake Max Thickness	A-D	E-G	0.00	1.2	5.36	8.21	9.055
RT Max Length	A-D	E-G	0.02	11.24	18.79	28.76	31.77

			A-D					
3rd Qu.	Max.	NA	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
42.79	62.39		15.42	22.37	30.35	30.1	35.75	54.91
35.47	54.11		10.23	17.78	23.40	23.33	28.57	43.47
24.5	50.62		5.77	13.3	15.48	17.16	21.46	31.61
41.78	75.98	1	8.09	16.03	21.84	24.78	31.3	77.03
30.64	49.5		4.16	10.68	15.44	17.33	21.98	64.62
11.59	39.08		1	3.61	5.65	6.64	8.82	23.08
43.3	56.72		9.09	18.03	23.62	25.09	29.51	60.02

NA

2

Results of Pairwise testing (adjusted p-values) where a significant relationship is identified by Group

Core Max Length	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F
BP_B	0.01	NA	NA	NA	NA	NA
BP_C	0.00	>0.05	NA	NA	NA	NA
BP_D	0.00	>0.05	>0.05	NA	NA	NA
BP_E	0.00	>0.05	>0.05	>0.05	NA	NA
BP_E_F	0.02	>0.05	>0.05	>0.05	>0.05	NA
BP_F	0.00	>0.05	>0.05	>0.05	>0.05	>0.05
BP_G	0.00	0.00	0.00	>0.05	0.00	>0.05

Core Max Width	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F
BP_B	0.00	NA	NA	NA	NA	NA
BP_C	0.00	0.04	NA	NA	NA	NA
BP_D	0.00	>0.05	>0.05	NA	NA	NA
BP_E	0.00	>0.05	>0.05	>0.05	NA	NA
BP_E_F	0.04	>0.05	>0.05	>0.05	>0.05	NA
BP_F	0.00	0.01	>0.05	0.05	>0.05	>0.05
BP_G	0.00	0.00	0.00	0.00	0.00	0.03

Core Max Thickness	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F
BP_B	0.01	NA	NA	NA	NA	NA
BP_C	0.00	0.01	NA	NA	NA	NA
BP_D	0.01	>0.05	>0.05	NA	NA	NA
BP_E	>0.05	>0.05	0.01	>0.05	NA	NA
BP_E_F	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_F	0.02	>0.05	>0.05	>0.05	>0.05	>0.05
BP_G	0.00	0.00	>0.05	0.03	0.00	>0.05

Flake Max Length	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F
BP_B	0.00	NA	NA	NA	NA	NA
BP_C	0.00	>0.05	NA	NA	NA	NA
BP_D	0.00	>0.05	>0.05	NA	NA	NA
BP_E	0.00	>0.05	>0.05	>0.05	NA	NA
BP_E_F	0.00	>0.05	0.05	>0.05	>0.05	NA
BP_F	0.00	>0.05	>0.05	>0.05	>0.05	>0.05
BP_G	0.00	0.00	0.00	0.00	0.00	>0.05

Flake Max Width	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F
BP_B	0.00	NA	NA	NA	NA	NA
BP_C	0.00	>0.05	NA	NA	NA	NA
BP_D	0.00	>0.05	>0.05	NA	NA	NA
BP_E	0.00	>0.05	>0.05	>0.05	NA	NA
BP_E_F	0.01	>0.05	>0.05	>0.05	>0.05	NA
BP_F	0.00	>0.05	>0.05	>0.05	>0.05	>0.05
BP_G	0.00	0.00	0.00	0.00	0.00	>0.05

Flake Max Thickness	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F
BP_B	0.00	NA	NA	NA	NA	NA
BP_C	0.00	>0.05	NA	NA	NA	NA
BP_D	0.00	>0.05	>0.05	NA	NA	NA

BP_E	0.00	>0.05	>0.05	>0.05	NA	NA
BP_E_F	0.00	>0.05	>0.05	>0.05	>0.05	NA
BP_F	0.00	>0.05	>0.05	>0.05	>0.05	>0.05
BP_G	0.00	0.00	0.00	0.00	0.00	>0.05

wise testing		Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
BP_F	A	15.42	16.45	18.37	19.74	20.12	30.35
NA	B	15.8	21.64	26.22	28.2	33.2	46.45
NA	C	18.11	27.99	32.23	32.29	37.26	49.43
NA	D	19.06	27.05	35.23	34.36	42.41	54.91
NA	E	17.88	25.7	28.28	30.19	33.75	47.53
NA	E/F	29.55	30.81	32.38	33.43	35	39.41
NA	F	20.42	29.58	36.3	37.29	48.22	48.75
>0.05	G	22.31	33.18	37.77	40.56	45.08	62.39
BP_F	A	10.23	12.12	14.21	15.1	14.64	25.34
NA	B	12.85	17.53	20.94	22.15	27.04	37.74
NA	C	15	21.62	26.4	26.1	29.83	36.98
NA	D	14.52	18.32	25.84	24.73	29.64	43.47
NA	E	14.96	20.96	24.04	24.25	27.34	35.63
NA	E/F	20.2	22.71	24.36	24.7	26.35	29.85
NA	F	19.85	26.09	33.61	33.63	41.75	46.23
>0.05	G	18.12	28.63	31.61	33.25	35.99	54.11
BP_F	A	5.77	9.22	10.32	10.54	12.83	14.79
NA	B	7.46	12.53	14.68	15.82	18.1	29.5
NA	C	12.41	15.51	20.02	20.08	24.05	31.61
NA	D	6.28	14.41	15.9	17.82	22.39	28.51
NA	E	3.82	9.76	13.97	14.17	18.96	22.61
NA	E/F	9.41	9.965	12.555	14.273	16.863	22.57
NA	F	11.29	13.84	17.02	19.25	22.57	33.64
>0.05	G	6.87	18.49	22.68	23	26.33	50.62
BP_F	A	8.51	14.34	17.35	18.03	21.54	35.86
NA	B	9.52	16.54	22.8	25.69	31.48	77.03
NA	C	8.09	16.32	23.05	25.48	33.05	66.48
NA	D	10.17	16.49	23.23	26.34	33.25	71.81
NA	E	9.84	19.47	26.57	29.18	36.05	69.96
NA	E/F	13.6	26.14	33.56	34.34	41.95	58.75
NA	F	11.36	18.8	22.51	25.7	29.7	58.4
0.00	G	10.34	29.67	36.44	37.05	44.15	75.98
BP_F	A	5.14	8.82	11.74	12.5	15.62	23.75
NA	B	6.54	12.36	16.49	18.09	22.27	40.18
NA	C	4.57	10.9	16.32	18.1	23.32	64.62
NA	D	4.16	10.91	15.59	17.93	22.59	46.15
NA	E	4.71	13.88	19.48	20.82	25.88	44.74
NA	E/F	6.09	14.85	17.75	22.18	32.27	40.73
NA	F	4.84	13.57	18.13	18.54	22.35	39.44
0.00	G	4.45	20.61	26.24	26.81	32.5	49.5
BP_F	A	1.52	3.132	4.115	4.433	5.272	11.88
NA	B	1	4.225	6.87	6.954	8.75	23.08
NA	C	1.35	3.85	6.27	7.138	9.78	21.2
NA	D	1.36	3.38	5.8	6.712	9.02	20.46

NA	E	1.69	4.178	6.92	7.083	9.845	15.97
NA	E/F	2.39	5.588	8.86	8.328	9.758	17.47
NA	F	1.2	4.04	6.02	7.941	9.015	39.08
0.00	G	1.56	7.29	9.7	10.36	12.5	26.91

NA
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Results of Pairwise testing (adjusted p-values) where a significant relationship is identified by Group

Raw material use between sites

	A	B	C	D	E	E-F	F
B	0.00	NA	NA	NA	NA	NA	NA
C	0.00	0.00	NA	NA	NA	NA	NA
D	0.00	0.01	0.00	NA	NA	NA	NA
E	0.00	0.00	0.01	0.00	NA	NA	NA
E-F	0.00	0.00	0.00	0.00	0.00	NA	NA
F	0.00	0.01	0.00	>0.05	>0.05	0.01	NA
G	0.00	0.00	0.00	0.00	0.00	0.00	0.00

wise testing

n	Quartz	Quartzite	Rhyolite	Siliceous
A	78	9	0	1
B	74	84	0	17
C	112	153	0	14
D	80	61	7	23
E	48	39	0	12
E_F	2	16	0	8
F	26	24	0	17
G	45	154	1	12

Results of Pairwise testing (adjusted p-values) where a significant relationship is identified by Groupwise

Core Max Length	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	>0.05	>0.05	NA
Siliceous	>0.05	0.00	>0.05

Core Max Width	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	>0.05	>0.05	NA
Siliceous	0.03	0.00	>0.05

Core Max Thickness	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	>0.05	>0.05	NA
Siliceous	>0.05	0.00	>0.05

Flake Max Length	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	0.00	>0.05	NA
Siliceous	>0.05	0.00	0.00

Flake Max Width	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	0.00	0.04	NA
Siliceous	0.00	0.00	0.00

Flake Max Thickness	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	0.00	>0.05	NA
Siliceous	0.00	0.00	0.00

RT Max Length	Quartz	Quartzite
Quartzite	0.00	NA
Siliceous	>0.05	0.00

RT Max Width	Quartz	Quartzite
Quartzite	0.00	NA
Siliceous	0.01	0.00

RT Max Thickness	Quartz	Quartzite
Quartzite	0.00	NA
Siliceous	0.00	0.00

testing	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA
Quartz	15.42	21.64	26.68	28.04	31.9	55.16	
Quartzite	17.82	31.5	37.09	38.28	42.55	62.39	
Rhyolite	45.24	45.24	45.24	45.24	45.24	45.24	
Siliceous	15.98	20.66	22.33	24.89	27.95	43.47	
Quartz	10.23	16.58	21.13	22.75	26.53	51.48	
Quartzite	15.7	26.19	29.3	30.65	34.33	54.11	
Rhyolite	33.11	33.11	33.11	33.11	33.11	33.11	
Siliceous	13.8	14.65	16.5	17.13	19.39	22.79	
Quartz	3.82	10.67	14.24	15.11	19.28	28.28	
Quartzite	9.41	16.86	20.95	21.51	25.19	50.62	
Rhyolite	26.4	26.4	26.4	26.4	26.4	26.4	
Siliceous	7.65	8.77	11.62	11.58	13.57	17.2	
Quartz	8.51	15.72	20.22	21.59	25.48	63.4	
Quartzite	8.09	23.51	33.28	33.99	42.17	85.73	1
Rhyolite	26.2	39.66	41.1	40.7	44.12	50.04	
Siliceous	10.02	14.24	18.95	20.4	25.35	42.11	
Quartz	4.16	10.11	14.2	14.99	18.7	43.28	
Quartzite	4.57	16.92	23.41	24.35	31.11	64.62	
Rhyolite	18.25	27.87	34.34	32.08	35.03	46.15	
Siliceous	4.71	7.125	11.81	12.217	15.305	35.97	
Quartz	1.36	3.515	5.15	5.743	7.415	25.07	1
Quartzite	1.86	5.85	8.665	9.368	12.02	26.91	1
Rhyolite	5.29	8.865	9.32	9.876	11.905	12.98	
Siliceous	1	2.235	3.44	4.606	5.355	39.08	
Quartz	10.57	17.58	23.18	23.74	27.18	48.82	
Quartzite	9.09	29.9	42	39.11	49.87	60.02	
Siliceous	12.13	14.18	16.62	21.14	24.59	50.44	
Quartz	3.53	10.9	16.27	16.45	20.95	40.4	
Quartzite	4.49	19	28.52	28.03	36.13	55.27	
Siliceous	3.62	4.817	8.62	12.644	15.255	39.64	
Quartz	1.54	3.94	5.79	6.318	7.59	16.69	
Quartzite	1.81	6.655	10.89	10.789	14.33	22.69	
Siliceous	1.23	1.81	2.935	4.372	3.665	12.58	

Results of Pairwise testing (adjusted p-values) where a significant relationship is identified by Groupwise te

Quartz

Core Max Length	BP_A	BP_B	BP_C	BP_D	BP_E	BP_F
BP_B	>0.05	NA	NA	NA	NA	NA
BP_C	0.02	>0.05	NA	NA	NA	NA
BP_D	0.03	>0.05	>0.05	NA	NA	NA
BP_E	0.04	>0.05	>0.05	>0.05	NA	NA
BP_F	0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	0.00	0.02	0.02	>0.05	0.01	>0.05

Core Max Width	BP_A	BP_B	BP_C	BP_D	BP_E	BP_F
BP_B	>0.05	NA	NA	NA	NA	NA
BP_C	0.02	>0.05	NA	NA	NA	NA
BP_D	0.02	>0.05	>0.05	NA	NA	NA
BP_E	0.02	>0.05	>0.05	>0.05	NA	NA
BP_F	0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	0.00	0.01	0.00	>0.05	0.01	>0.05

Core Max Thickness	BP_A	BP_B	BP_C	BP_D	BP_E	BP_F
BP_B	>0.05	NA	NA	NA	NA	NA
BP_C	0.02	>0.05	NA	NA	NA	NA
BP_D	>0.05	>0.05	>0.05	NA	NA	NA
BP_E	>0.05	>0.05	>0.05	>0.05	NA	NA
BP_F	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	0.00	0.03	>0.05	>0.05	0.03	>0.05

Flake Max Length	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F	BP_F
BP_B	0.00	NA	NA	NA	NA	NA	NA
BP_C	>0.05	0.01	NA	NA	NA	NA	NA
BP_D	>0.05	>0.05	>0.05	NA	NA	NA	NA
BP_E	0.00	>0.05	0.00	>0.05	NA	NA	NA
BP_E_F	>0.05	>0.05	>0.05	>0.05	>0.05	NA	NA
BP_F	>0.05	>0.05	>0.05	>0.05	0.03	>0.05	NA
BP_G	0.00	0.01	0.00	0.00	>0.05	>0.05	0.00

Flake Max Width	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F	BP_F
BP_B	0.00	NA	NA	NA	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA	NA	NA	NA
BP_D	>0.05	>0.05	>0.05	NA	NA	NA	NA
BP_E	0.00	>0.05	0.01	0.02	NA	NA	NA
BP_E_F	>0.05	>0.05	>0.05	>0.05	>0.05	NA	NA
BP_F	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	0.00	>0.05	0.00	0.01	>0.05	>0.05	>0.05

Flake Max Thickness	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F	BP_F
BP_B	0.00	NA	NA	NA	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA	NA	NA	NA
BP_D	>0.05	>0.05	>0.05	NA	NA	NA	NA
BP_E	0.01	>0.05	>0.05	>0.05	NA	NA	NA

BP_E_F	>0.05	>0.05	>0.05	>0.05	>0.05	NA	NA
BP_F	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	0.00	>0.05	0.01	0.01	>0.05	>0.05	>0.05

Retouched Max Length	BP_A	BP_B	BP_C	BP_D	BP_E	BP_F
BP_B	>0.05	NA	NA	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA	NA	NA
BP_D	>0.05	>0.05	>0.05	NA	NA	NA
BP_E	0.03	>0.05	0.03	>0.05	NA	NA
BP_F	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Quartzite

Core Max Length	BP_B	BP_C	BP_D	BP_E	BP_E_F	BP_F
BP_C	>0.05	NA	NA	NA	NA	NA
BP_D	>0.05	>0.05	NA	NA	NA	NA
BP_E	>0.05	>0.05	>0.05	NA	NA	NA
BP_E_F	>0.05	>0.05	>0.05	>0.05	NA	NA
BP_F	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	0.01	>0.05	>0.05	>0.05	>0.05	>0.05

Core Max Width	BP_B	BP_C	BP_D	BP_E	BP_E_F	BP_F
BP_C	>0.05	NA	NA	NA	NA	NA
BP_D	>0.05	>0.05	NA	NA	NA	NA
BP_E	>0.05	>0.05	>0.05	NA	NA	NA
BP_E_F	>0.05	>0.05	>0.05	>0.05	NA	NA
BP_F	0.04	>0.05	>0.05	>0.05	>0.05	NA
BP_G	0.00	0.05	0.04	>0.05	>0.05	>0.05

Core Max Thickness	BP_B	BP_C	BP_D	BP_E	BP_E_F	BP_F
BP_C	>0.05	NA	NA	NA	NA	NA
BP_D	>0.05	>0.05	NA	NA	NA	NA
BP_E	>0.05	>0.05	>0.05	NA	NA	NA
BP_E_F	>0.05	>0.05	>0.05	>0.05	NA	NA
BP_F	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Flake Max Length	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F	BP_F
BP_B	>0.05	NA	NA	NA	NA	NA	NA
BP_C	0.03	>0.05	NA	NA	NA	NA	NA
BP_D	0.01	>0.05	>0.05	NA	NA	NA	NA
BP_E	0.02	>0.05	>0.05	>0.05	NA	NA	NA
BP_E_F	0.01	0.01	0.01	>0.05	>0.05	NA	NA
BP_F	0.00	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	0.00	0.00	0.00	0.04	>0.05	>0.05	>0.05

Flake Max Width	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F	BP_F
BP_B	>0.05	NA	NA	NA	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA	NA	NA	NA

BP_D	0.02	>0.05	>0.05	NA	NA	NA	NA
BP_E	0.03	>0.05	>0.05	>0.05	NA	NA	NA
BP_E_F	0.02	>0.05	>0.05	>0.05	>0.05	NA	NA
BP_F	0.01	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	0.00	0.00	0.00	0.01	>0.05	>0.05	>0.05

Flake Max Thickness	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F	BP_F
BP_B	0.02	NA	NA	NA	NA	NA	NA
BP_C	0.02	>0.05	NA	NA	NA	NA	NA
BP_D	0.00	>0.05	>0.05	NA	NA	NA	NA
BP_E	0.03	>0.05	>0.05	>0.05	NA	NA	NA
BP_E_F	0.02	>0.05	>0.05	>0.05	>0.05	NA	NA
BP_F	0.01	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	0.00	0.00	0.00	>0.05	>0.05	>0.05	>0.05

Retouched Max Length	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F	BP_F
BP_B	>0.05	NA	NA	NA	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA	NA	NA	NA
BP_D	>0.05	>0.05	>0.05	NA	NA	NA	NA
BP_E	>0.05	>0.05	>0.05	>0.05	NA	NA	NA
BP_E_F	>0.05	>0.05	>0.05	>0.05	>0.05	NA	NA
BP_F	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Retouched Max Thickness	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F	BP_F
BP_B	>0.05	NA	NA	NA	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA	NA	NA	NA
BP_D	>0.05	>0.05	>0.05	NA	NA	NA	NA
BP_E	>0.05	>0.05	>0.05	>0.05	NA	NA	NA
BP_E_F	>0.05	>0.05	0.04	>0.05	>0.05	NA	NA
BP_F	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Siliceous

Flake Max Length	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F	BP_F
BP_B	>0.05	NA	NA	NA	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA	NA	NA	NA
BP_D	>0.05	>0.05	>0.05	NA	NA	NA	NA
BP_E	>0.05	>0.05	>0.05	>0.05	NA	NA	NA
BP_E_F	>0.05	>0.05	>0.05	>0.05	>0.05	NA	NA
BP_F	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_G	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

esting

Site	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
A	15.42	16.45	18.37	19.74	20.12	30.35	
B	15.8	20.96	22.59	23.08	24.17	34.38	
C	18.11	24.33	27.52	26.97	29.8	34.58	
D	19.06	21.42	31.29	32.38	39.64	50.8	
E	17.88	24.83	26.25	25.38	27.92	29.19	
F	24.53	29.58	34.63	35.97	41.69	48.75	
G	22.31	30.19	33.89	33.81	37.52	44.61	
A	10.23	12.12	14.21	15.1	14.64	25.34	
B	12.85	18.51	19.07	19.62	20.23	28.72	
C	15	19.8	21.09	20.99	23.36	25.16	
D	14.64	15.87	21.3	22.93	30.5	32.29	
E	14.96	17.27	22.85	21.35	24.39	26.5	
F	21.93	26.09	30.26	32.21	37.34	44.43	
G	18.12	26.33	28.98	29.49	31.43	40.76	
A	5.77	9.22	10.32	10.54	12.83	14.79	
B	7.46	11.79	12.89	13.58	15.25	20.34	
C	12.41	13.8	14.2	16.15	17.08	24.55	
D	6.28	11.73	14.47	15.88	21.56	26.75	
E	3.82	8.658	10.93	12.218	15.71	20.56	
F	11.29	14.15	17.02	15.19	17.14	17.25	
G	6.87	17.69	20.52	20.31	23.25	28.28	
A	8.51	14.01	16.79	17.85	21.54	35.86	
B	10.79	16.46	22	22.3	27.16	35.18	
C	9.57	14.87	17.09	18.64	22.14	33.42	
D	10.17	15.15	19.27	21.01	25.36	44.59	
E	11.77	18.47	24.91	24.99	28.88	51.79	
E_F	13.6	13.6	13.6	13.6	13.6	13.6	
F	12.92	16.03	18.99	19.35	20.89	31.23	
G	10.9	22.87	30.93	30.83	38.37	63.4	
A	5.14	8.57	10.79	12.23	15.62	23.75	
B	7.75	12.67	15.8	15.7	19	26.59	
C	5.23	9.585	13.625	13.349	15.883	27.83	
D	4.16	10.52	12.72	13.94	18.21	32.41	
E	5.36	14.09	17.39	18.33	22	43.28	
E_F	8.1	8.1	8.1	8.1	8.1	8.1	
F	5.98	9.25	15.63	15.17	18.98	30.38	
G	4.45	14.54	19.43	20.32	25.48	41.81	
A	1.52	2.815	4.115	4.494	5.535	11.88	
B	2.41	4.612	5.705	6.268	8.14	11.72	
C	1.83	3.4	4.835	5.061	6.272	9.79	
D	1.36	2.8	4.81	5.144	6.63	14.19	1
E	2.13	4.612	5.505	6.241	8.03	11.06	

E_F	2.84	2.84	2.84	2.84	2.84	2.84	
F	2.37	4.018	5.06	5.625	7.145	10.57	
G	1.93	4.74	7.6	8.905	11.9	25.07	
A	14.69	16.22	17.38	17.02	18.18	18.62	
B	12.93	18.27	22.18	23.57	29.04	39.47	
C	10.57	16.12	22.48	21.21	24.09	35.85	
D	13.28	19.83	24.24	24.58	27.12	48.82	
E	20.36	24.87	35.03	33.2	41.35	48.65	
F	14.3	20.84	27.38	24.42	29.48	31.57	
G	11.24	12.09	14.71	19.9	21.53	39.93	

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
B	17.82	27.91	31.16	32.63	36.69	46.45	
C	27.13	32.3	36.6	35.55	37.84	49.43	
D	20.83	28.39	35.49	35.24	40.74	54.91	
E	28.51	38.31	42.2	39.81	42.52	47.53	
E_F	31.23	32.38	33.53	34.72	36.47	39.41	
F	36.3	42.1	47.9	44.24	48.22	48.53	
G	29.93	36.05	40.95	43.89	52.02	62.39	
B	15.7	23.11	25.95	25.44	27.97	37.74	
C	21.62	26.47	28.8	29.22	30.91	36.98	
D	17.56	21.16	28.28	27.36	29.22	43.47	
E	24.04	28.18	28.48	30.04	33.85	35.63	
E_F	23.55	24.36	25.18	26.19	27.52	29.85	
F	33.61	36.34	39.07	39.64	42.65	46.23	
G	21.28	30.58	32.61	35.2	36.38	54.11	
B	13.36	14.87	17.23	18.45	20.44	29.5	
C	15.6	19.65	22.84	22.49	24.94	31.61	
D	14.86	15.66	19.64	20.59	25.33	28.51	
E	13.52	16.06	17.57	18.09	20.68	22.61	
E_F	9.41	9.78	10.15	14.04	16.36	22.57	
F	14.98	21.44	27.9	25.51	30.77	33.64	
G	13.01	19.29	24.01	24.26	26.72	50.62	
A	14.46	15.5	19.51	18.9	21.11	25.08	
B	9.52	18.19	30.43	30.01	36.97	77.03	
C	8.09	21.14	29.21	29.54	36.7	66.48	
D	11.96	22.52	32.55	33.88	43.46	71.81	
E	9.84	24.89	36.72	35.76	47.39	69.96	
E_F	37.71	39.47	44.09	45.59	49.25	58.75	
F	19.24	26.17	28.07	34.01	42.56	58.4	1
G	10.34	31.48	37.96	38.99	46.28	75.98	
A	10.06	12.71	13.09	14.22	14.88	21.25	
B	6.64	13.73	20.55	21.13	29.45	40.18	
C	4.57	14.82	19.75	21.13	25.76	64.62	

D	7.37	16.74	22.5	24.01	28.74	45.97	
E	5.59	18.75	24.7	25.32	34.26	44.74	
E_F	16.63	21.58	34.83	31.02	40.16	40.73	
F	14.65	19.5	22.44	24.54	30.9	39.44	
G	6.78	23.37	28.2	28.71	33.24	49.5	
A	3.13	3.645	3.81	3.943	4.455	4.46	
B	2.41	4.515	7.59	8.042	9.845	23.08	
C	1.86	5.04	8.14	8.45	11.43	21.2	1
D	1.87	5.785	7.995	9.552	13.438	20.46	
E	1.89	6.975	9.025	8.834	11.535	15.97	
E_F	5.91	8.67	9.93	10.75	12.25	17.47	
F	2.57	5.935	7.7	10.581	14.143	26.8	
G	2.26	7.793	10.045	10.916	13.627	26.91	
A	28.04	28.04	28.04	28.04	28.04	28.04	
B	19.27	29.28	30.52	31.63	33.05	46.03	
C	9.09	25.16	32.05	31.21	35.59	52.26	
D	34.25	46.43	52.35	49.74	55.66	60.02	
E	21.15	22.23	23.3	28.82	32.65	42	
E_F	45.71	45.92	50.99	50.26	52.71	55.97	
F	28.76	31.57	34.38	34.38	37.18	39.99	
G	14.41	34.25	46.5	43.2	54.97	56.72	
A	5.96	5.96	5.96	5.96	5.96	5.96	
C	1.81	5.63	6.695	6.6	8.365	9.7	
E	3.3	3.43	3.56	6.063	7.445	11.33	
F	10.89	11.05	11.21	11.21	11.38	11.54	
B	4.26	5.53	9.78	9.294	12.35	14.55	
D	8.23	10.7	13.7	13.04	16.04	16.54	
G	2.22	7.407	13.475	11.604	15.457	18.42	
E_F	12.63	12.91	13.28	16.48	20.88	22.69	

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
A	21.74	21.74	21.74	21.74	21.74	21.74	
B	10.38	12.53	15.3	16.55	18.09	28.13	
C	11.11	13.4	15.31	15.28	17.2	19.13	
D	11.3	15.89	19.21	19.81	23.21	34.07	
E	10.02	11.63	18.52	19.17	25.55	31.45	
E_F	17.37	22.53	27.34	24.99	28.31	29.42	
F	11.36	18.09	21.66	23.47	27.77	41.58	
G	14.93	20.39	23.89	25.34	26.96	42.11	

Results of Pairwise testing (adjusted p-values) where a significant relationship is identified by Grour

Debitage Cortex %	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	>0.05	>0.05	NA
Siliceous	0.00	0.02	>0.05

Debitage Cortex SA	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	>0.05	>0.05	NA
Siliceous	0.00	0.03	>0.05

Debitage Cortex %	A	B	C	D	E	E-F	F
B	>0.05	NA	NA	NA	NA	NA	NA
C	>0.05	>0.05	NA	NA	NA	NA	NA
D	>0.05	>0.05	0.01	NA	NA	NA	NA
E	>0.05	>0.05	>0.05	>0.05	NA	NA	NA
E-F	>0.05	>0.05	>0.05	>0.05	>0.05	NA	NA
F	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	NA
G	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Debitage Cortex SA	A	B	C	D	E	E-F	F
B	>0.05	NA	NA	NA	NA	NA	NA
C	>0.05	>0.05	NA	NA	NA	NA	NA
D	>0.05	>0.05	0.01	NA	NA	NA	NA
E	>0.05	>0.05	>0.05	>0.05	NA	NA	NA
E-F	>0.05	>0.05	>0.05	>0.05	>0.05	NA	NA
F	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	NA
G	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Quartz	0	0	0	0.3448	0	70
Quartzite	0	0	0	2.464	0	100
Rhyolite	0	0	0	0	0	0
Siliceous	0	0	0	4.953	0	90
Quartz	0	0	0	1.068	0	377.2
Quartzite	0	0	0	21.22	0	1710
Rhyolite	0	0	0	0	0	0
Siliceous	0	0	0	25.77	0	1600
A	0	0	0	0	0	0
B	0	0	0	2.388	0	60
C	0	0	0	1.567	0	90
D	0	0	0	7.347	0	90
E	0	0	0	0.3333	0	5
E_F	0	0	0	5.385	0	40
F	0	0	0	1.429	0	20
G	0	0	0	2.756	0	100
A	0	0	0	0	0	0
B	0	0	0	5.292	0	132.3
C	0	0	0	5.003	0	251.2
D	0	0	0	81.51	0	1710
E	0	0	0	7.715	0	195.6
E_F	0	0	0	47.61	0	398.8
F	0	0	0	5.282	0	88.5
G	0	0	0	31.91	0	1254

NA's
10
9
1
1
1
2
4

Results of Pairwise testing (adjusted p-values) where a significant relationship is identified by Groupwis

Core Axial Length	Quartz	Quartzite	Rhyolite
Quartzite	0.00		
Rhyolite	>0.05	>0.05	
Siliceous	0.05	0.00	>0.05

Core Axial Proximal Width	Quartz	Quartzite	Rhyolite
Quartzite	0.00		
Rhyolite	>0.05	>0.05	
Siliceous	>0.05	0.00	>0.05

Core Axial Medial Width	Quartz	Quartzite	Rhyolite
Quartzite	0.00		
Rhyolite	>0.05	>0.05	
Siliceous	>0.05	0.00	>0.05

Core Axial Distal Width	Quartz	Quartzite	Rhyolite
Quartzite	0.00		
Rhyolite	>0.05	>0.05	
Siliceous	>0.05	0.00	>0.05

Core Medial Axial Thickness	Quartz	Quartzite	Rhyolite
Quartzite	0.00		
Rhyolite	>0.05	>0.05	
Siliceous	>0.05	0.00	>0.05

Quartz

Core Axial Length	A	B	C	D	E	F
B	>0.05	NA	NA	NA	NA	NA
C	>0.05	>0.05	NA	NA	NA	NA
D	>0.05	>0.05	>0.05	NA	NA	NA
E	>0.05	>0.05	>0.05	>0.05	NA	NA
F	>0.05	>0.05	>0.05	>0.05	>0.05	NA
G	0.01	0.01	>0.05	>0.05	>0.05	>0.05

Core Axial Proximal Width	A	B	C	D	E	F
B	>0.05	NA	NA	NA	NA	NA
C	0.04	>0.05	NA	NA	NA	NA
D	>0.05	>0.05	>0.05	NA	NA	NA
E	>0.05	>0.05	>0.05	>0.05	NA	NA
F	0.05	>0.05	>0.05	>0.05	>0.05	NA
G	0.00	0.04	>0.05	>0.05	>0.05	>0.05

Core Axial Medial Width	A	B	C	D	E	F
B	>0.05	NA	NA	NA	NA	NA
C	>0.05	>0.05	NA	NA	NA	NA
D	>0.05	>0.05	>0.05	NA	NA	NA
E	>0.05	>0.05	>0.05	>0.05	NA	NA
F	>0.05	>0.05	>0.05	>0.05	>0.05	NA

G	0.01	0.04	>0.05	>0.05	>0.05	>0.05

Core Axial Distal Width	A	B	C	D	E	F
B	>0.05	NA	NA	NA	NA	NA
C	>0.05	>0.05	NA	NA	NA	NA
D	>0.05	>0.05	>0.05	NA	NA	NA
E	>0.05	>0.05	>0.05	>0.05	NA	NA
F	>0.05	>0.05	>0.05	>0.05	>0.05	NA
G	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Core Medial Axial Thickness	A	B	C	D	E	F
B	>0.05	NA	NA	NA	NA	NA
C	>0.05	>0.05	NA	NA	NA	NA
D	>0.05	>0.05	>0.05	NA	NA	NA
E	>0.05	>0.05	>0.05	>0.05	NA	NA
F	>0.05	>0.05	>0.05	>0.05	>0.05	NA
G	0.00	>0.05	>0.05	>0.05	>0.05	>0.05

Quartzite

Core Axial Length	B	C	D	E	E_F	F
C	>0.05	NA	NA	NA	NA	NA
D	>0.05	>0.05	NA	NA	NA	NA
E	>0.05	>0.05	>0.05	NA	NA	NA
E-F	>0.05	>0.05	>0.05	>0.05	NA	NA
F	>0.05	0.02	>0.05	>0.05	>0.05	NA
G	0.00	0.01	>0.05	>0.05	>0.05	>0.05

Core Medial Axial Thickness	B	C	D	E	E_F	F
C	>0.05	NA	NA	NA	NA	NA
D	>0.05	>0.05	NA	NA	NA	NA
E	>0.05	>0.05	>0.05	NA	NA	NA
E-F	>0.05	>0.05	>0.05	>0.05	NA	NA
F	>0.05	>0.05	>0.05	>0.05	>0.05	NA
G	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Flaking Directionality of All Cores by Debitage Type

	X-squared	df	p
Pearson's Chi-squared test	55.07	2.00	0.00

Flaking Directionality	A	B	C	D	E	E_F
B	>0.05	NA	NA	NA	NA	NA
C	>0.05	>0.05	NA	NA	NA	NA
D	0.05	>0.05	>0.05	NA	NA	NA
E	>0.05	>0.05	>0.05	>0.05	NA	NA
E_F	>0.05	>0.05	>0.05	>0.05	>0.05	NA
F	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
G	0.00	0.00	0.00	>0.05	>0.05	>0.05

Flaking Directionality between Cores and Flakes in BP A

UniBi	>0.05
UniMulti	0.02
BiMulti	>0.05

se testing	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
Quartz	9.25	16.96	21.06	21.95	26.15	48.66	3
Quartzite	15.98	25.13	28.84	30.61	35.11	60.17	
Rhyolite	40.8	40.8	40.8	40.8	40.8	40.8	
Siliceous	9.72	11.4	14.94	16.12	19.31	28.15	2
Quartz	8.88	15.71	19.83	20.63	23.52	47.9	3
Quartzite	13.63	23.59	26.92	28.98	31.96	60.8	1
Rhyolite	24.14	24.14	24.14	24.14	24.14	24.14	
Siliceous	12.05	15.04	16.57	18.05	19.64	29.03	2
Quartz	9.48	15.71	19.28	20.68	23.84	39.46	4
Quartzite	12.29	23.54	26.66	28.9	31.72	52.37	1
Rhyolite	33.41	33.41	33.41	33.41	33.41	33.41	
Siliceous	11.13	14.32	15.16	17.09	18.62	29.48	2
Quartz	7.02	11.64	14.92	16.54	21.26	42.31	4
Quartzite	9.21	17.36	20.89	22.49	26.57	42.94	1
Rhyolite	25.87	25.87	25.87	25.87	25.87	25.87	
Siliceous	8.68	8.852	12.17	12.96	15.2	20.02	2
Quartz	4.33	11.45	14.62	15.8	20.95	37.49	4
Quartzite	9.53	15.96	20.05	20.76	24.44	49.29	1
Rhyolite	27.56	27.56	27.56	27.56	27.56	27.56	
Siliceous	6.35	10.15	12.37	11.6	13.29	15.89	2

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
A	9.25	11.75	13.4	15.53	18.53	30.35	
B	12.09	14.63	16.87	16.8	18.92	22.78	
C	14.67	18.42	21.22	21.36	24.14	28.98	
D	13.16	19.72	26.96	26.2	29.35	43.99	1
E	11.5	19.96	21.16	20.07	22.15	22.42	1
F	20.53	26.99	33.45	30.3	35.19	36.93	
G	16.3	20.52	24.45	24.96	28.92	32.95	
A	8.88	12.04	14.56	14.17	17.48	19.79	
B	12.76	15.3	16.91	18.04	19.98	25.57	
C	13.86	16.46	20.66	20.14	22.74	28.05	
D	11.6	14.98	19.35	18.99	23.03	25.97	2
E	12.51	17.35	19.72	19.31	23.32	23.76	1
F	20.45	22.76	25.08	25.32	27.76	30.43	
G	16.84	21.35	24.06	26.38	32.38	40.43	
A	9.48	12.3	14.38	14.74	15.57	21.6	
B	10.73	13	14.37	16	18.08	25.47	
C	12.55	16.33	20.18	19.96	22.48	28.79	
D	15.99	18.1	21.05	22.08	22.9	35.55	2
E	12.5	17.59	18.93	20.32	24.65	28.96	1
F	20.57	25.1	29.64	29.74	34.33	39.01	

G	15.18	19.84	23.84	24.88	28.71	34.69	
A	8.26	9.87	10.02	11.99	11.74	21.36	
B	7.1	9.545	12.54	13.02	14.43	23.63	
C	10.81	11.4	13.89	15.61	19.72	24.69	
D	12.68	14.48	16.42	17.45	19.73	24.64	2
E	8.85	12.9	16.05	14.92	16.11	22.09	1
F	16.2	21.68	27.16	28.56	34.74	42.31	
G	9.7	14.4	21.2	20.45	25.6	33.76	
A	4.33	7.67	10.6	10.39	13.23	15.15	
B	7.27	11.76	14.44	14.19	16.52	21.98	
C	11.45	13.5	13.92	16.08	18.45	24.97	
D	7.02	12.82	14.76	18.29	21.55	37.49	2
E	7.37	8.96	11.54	14.45	20.01	25.54	1
F	10.44	12.86	15.28	13.87	15.58	15.88	
G	7.26	17.42	21.74	20.91	24.26	34.26	

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
B	15.98	20.12	21.57	25.07	26.89	41.8	
C	19.79	24.81	27.77	27.74	30.68	34.96	
D	19.11	26.22	28.08	29.57	31.53	43.37	
E	19.75	22.45	28.05	27.95	33.92	35.58	
E_F	22.6	24.03	25.46	25.69	27.23	29	
F	32.89	34.94	36.99	37.83	40.3	43.62	
G	23.81	29.36	33.15	36.2	42.16	60.17	
B	13.14	13.93	17.31	17.92	18.99	30.44	
C	12.01	18.63	20.92	20.87	23.97	32.74	
D	12.75	15.24	20.2	20.18	24.92	27.91	
E	12.02	17.09	20.13	18.69	22.07	22.12	
E_F	9.53	9.845	10.16	13.19	15.02	19.88	
F	10.01	16.72	23.43	21.63	27.44	31.44	
G	11.73	17.8	23.14	24.11	27.11	49.29	1

	Bidirection	Multidirec	Unidirectional
A	13	8	47
B	19	21	63
C	48	43	114
D	24	37	59
E	17	20	36
E_F	6	5	7
F	11	12	17
G	28	65	58

Results of Pairwise testing (adjusted p-values) where a significant relationship is identified by Groupwise test

Core Scar Count	Quartz	Quartzite	Rhyolite	Quartz
Quartzite	0.00			Quartzite
Rhyolite	>0.05	>0.05		Rhyolite
Siliceous	>0.05	0.00	>0.05	Siliceous

Core Scar Density	Quartz	Quartzite	Rhyolite	Quartz
Quartzite	0.00			Quartzite
Rhyolite	>0.05	>0.05		Rhyolite
Siliceous	>0.05	0.00	>0.05	Siliceous

Core Aberrant Terminations	Quartz	Quartzite	Rhyolite	Quartz
Quartzite	0.02			Quartzite
Rhyolite	>0.05	>0.05		Rhyolite
Siliceous	>0.05	>0.05	>0.05	Siliceous

Quartz

Quartz Core Scar Count by Site	B	C	D	E	F	B
C	>0.05	NA	NA	NA	NA	C
D	>0.05	>0.05	NA	NA	NA	D
E	>0.05	>0.05	>0.05	NA	NA	E
F	>0.05	>0.05	>0.05	>0.05	NA	F
G	0.01	>0.05	>0.05	>0.05	>0.05	G

Type

Core Scar Count	Blade	Blade
Flake	0.00	Flake

Core Scar Density	Blade	Blade
Flake	0.00	Flake

Core Aberant Terminations	Blade	Blade
Flake	0.00	Flake

Directionality

Core Scar Density	Bidirection	Multidirectional	Bidirection
Multidirectional	0.00	NA	Multidirect
Unidirectional	0.00	>0.05	Unidirectic

Core Core Rotations	Bidirection	Multidirectional	Bidirection
Multidirectional	>0.05	NA	Multidirect
Unidirectional	0.00	0.00	Unidirectic

Core Aberrant Terminations	Bidirection	Multidirectional	Bidirection
Multidirectional	>0.05	NA	Multidirect
Unidirectional	>0.05	0.03	Unidirectic

Proportion of Core Management Flakes	A	B	C	D	E	E_F
B	>0.05	NA	NA	NA	NA	NA
C	>0.05	>0.05	NA	NA	NA	NA
D	>0.05	>0.05	>0.05	NA	NA	NA
E	>0.05	>0.05	>0.05	>0.05	NA	NA
E_F	0.05	>0.05	>0.05	>0.05	>0.05	NA
F	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
G	0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Raw Material

Proportion of Core Management Flakes	Siliceous	Quartzite
Quartzite	>0.05	NA
Quartz	>0.05	0.00

Directionality

Proportion of Core Management Flakes	Unidirectic	Bidirectional
Bidirectional	0.00	
Multidirectional	0.00	0.00

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
0	0	1	1.758	3	9	3
0	3	4	4.964	7	13	1
8	8	8	8	8	8	
0	0	0	1.3	0.75	9	
0	0	0.0005964	0.00276	0.002446	0.02427	3
0	0.001463	0.002739	0.006758	0.006008	0.05536	1
0.00175	0.001746	0.001746	0.001746	0.001746	0.001746	
0	0	0	0.002412	0.000602	0.02144	
0	0	0	0.8529	1	6	1
0	0	1	1.602	2	8	1
2	2	2	2	2	2	
0	0	0	0.7	0.75	3	
0	0	0.5	0.625	1	2	
0	0	2	1.818	3	4	
0	1	2	1.667	2	4	
0	1	1	1.429	2	3	3
0	0.5	1	2.333	3.5	6	
1	2	3.5	3.786	5	9	
0	2	4	4.397	7	13	1
0	0	2	2.512	4	9	3
0	0.001381	0.002645	0.005737	0.00536	0.05536	1
0	0	0.0008752	0.00392	0.002906	0.03986	3
0	0	1	1.823	3	8	
0	0	0	0.6747	1	5	2
0	0.003801	0.0121	0.01557	0.02116	0.05536	
0	0	0.0007449	0.003445	0.002354	0.03986	2
0	0.000634	0.001956	0.003664	0.004246	0.02922	1
0	1	1	1.25	2	2	
0	1	1	1.388	2	3	
0	0	1	0.6632	1	3	1
0	0	0.5	1.312	1.25	8	
0	0	0	0.6667	1	3	1
0	0	1	1.49	2.25	7	

		No	Yes
F	A	69	1
NA	B	109	8
NA	C	212	16
NA	D	132	8
NA	E	71	10
NA	E_F	15	5
NA	F	50	6
>0.05	G	144	22

	Quartz	368	15
	Quartzit	409	61
	Siliceou	91	6

	Bidirect	170	13
	Multidirec	171	55
	Unidirectic	436	9

Results of Pairwise testing (adjusted p-values) where a significant relationship is identified by Groupwi

Core Platform Width	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	>0.05	>0.05	NA
Siliceous	>0.05	0.00	>0.05

Core Platform Depth	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	>0.05	>0.05	NA
Siliceous	>0.05	0.00	>0.05

Core Surface Area	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	>0.05	>0.05	NA
Siliceous	>0.05	0.00	>0.05

Core Size Corrected Platform Area	Quartz	Quartzite	Rhyolite
Quartzite	>0.05	NA	NA
Rhyolite	>0.05	>0.05	NA
Siliceous	>0.05	>0.05	>0.05

Quartz

Core Platform Width	A	B	C	D
B	>0.05	NA	NA	NA
C	0.04	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	0.01	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	0.00	0.04	0.05	>0.05

Core Platform Depth	A	B	C	D
B	>0.05	NA	NA	NA
C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	>0.05	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	0.01	>0.05	>0.05	>0.05

Core Platform Surface Area	A	B	C	D
B	>0.05	NA	NA	NA
C	0.02	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	0.02	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	0.00	0.04	0.02	>0.05

Core Platform Preparation	A	B	C	D

B	>0.05	NA	NA	NA
C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	>0.05	>0.05	>0.05	>0.05
E_F	>0.05	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	>0.05	>0.05	>0.05	>0.05

Quartzite

Core Platform Width	B	C	D	E
C	>0.05	NA	NA	NA
D	>0.05	>0.05	NA	NA
E	>0.05	>0.05	>0.05	NA
EF	>0.05	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	>0.05	>0.05	>0.05	>0.05

Core Platform Type	Flake
Blade	0.00

Size Corrected Platform Area	Bidirectional	Multidirectional
Multidirectional	>0.05	NA
Unidirectional	0.00	0.03

Debitage

Raw Material

Flake Platform Width	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	0.00	0.12	NA
Siliceous	0.00	0.00	0.00

Flake Platform Depth	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	0.01	>0.05	NA
Siliceous	0.00	0.00	0.00

Flake Platform Surface Area	Quartz	Quartzite	Rhyolite
Quartzite	0.00	NA	NA
Rhyolite	0.00	>0.05	NA
Siliceous	0.00	0.00	0.00

Flake Size Corrected Platform Area	Quartz	Quartzite	Rhyolite
Quartzite	>0.05	NA	NA
Rhyolite	>0.05	>0.05	NA
Siliceous	0.00	0.00	>0.05

Flake Platform Type	Quartz	Quartzite	Siliceous
Quartzite	0.00		
Siliceous	0.00	0.00	
Rhyolite	>0.05	>0.05	0.01

Type

Flake Platform Width	Blade	Core_Man	Flake
Core_Management	0.00	NA	NA
Flake	0.00	>0.05	NA
Point	0.00	>0.05	0.01

Flake Platform Depth	Blade	Core_Man	Flake
Core_Management	0.00	NA	NA
Flake	0.00	0.01	NA
Point	0.00	>0.05	0.10

Flake Platform Surface Area	Blade	Core_Man	Flake
Core_Management	0.00	NA	NA
Flake	0.00	0.02	NA
Point	0.00	0.85	0.03

Flake Size Corrected Platform Area	Blade	Core_Man	Flake
Core_Management	>0.05	NA	NA
Flake	0.00	0.02	NA
Point	0.03	>0.05	>0.05

Flake Platform Preparation			
Core_Management	>0.05		
Flake	>0.05	>0.05	
Point	0.01	>0.05	0.01

Flake Platform Type	Blade	Core_Man	Flake
Core_Management	0.03		
Flake	0.00	>0.05	
Point	0.01	>0.05	>0.05

Quartz

Flake Platform Width	BP_A	BP_B	BP_C	BP_D
BP_B	0.01	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA
BP_D	0.05	>0.05	>0.05	NA
BP_E	0.01	>0.05	>0.05	>0.05

BP_E_F	>0.05	>0.05	>0.05	>0.05
BP_F	>0.05	>0.05	>0.05	>0.05
BP_G	0.01	>0.05	0.05	>0.05

Flake Platform Depth	BP_A	BP_B	BP_C	BP_D
BP_B	>0.05	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA
BP_D	>0.05	>0.05	>0.05	NA
BP_E	>0.05	>0.05	>0.05	>0.05
BP_E_F	>0.05	>0.05	>0.05	>0.05
BP_F	>0.05	>0.05	>0.05	>0.05
BP_G	0.02	>0.05	0.02	>0.05

Flake Platform Surface Area	BP_A	BP_B	BP_C	BP_D
BP_B	0.02	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA
BP_D	>0.05	>0.05	>0.05	NA
BP_E	0.02	>0.05	0.04	>0.05
BP_E_F	>0.05	>0.05	>0.05	>0.05
BP_F	>0.05	>0.05	>0.05	>0.05
BP_G	0.02	>0.05	0.02	>0.05

Quartzite

Flake Platform Width	BP_A	BP_B	BP_C	BP_D
BP_B	>0.05	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA
BP_D	>0.05	>0.05	>0.05	NA
BP_E	>0.05	>0.05	>0.05	>0.05
BP_E_F	0.04	0.02	0.04	>0.05
BP_F	>0.05	>0.05	>0.05	>0.05
BP_G	0.04	0.00	0.00	>0.05

Flake Platform Depth	BP_A	BP_B	BP_C	BP_D
BP_B	>0.05	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA
BP_D	>0.05	>0.05	>0.05	NA
BP_E	>0.05	>0.05	>0.05	>0.05
BP_E_F	0.02	0.02	0.03	0.09
BP_F	>0.05	>0.05	>0.05	>0.05
BP_G	0.02	0.02	0.02	>0.05

Flake Platform Surface Area	BP_A	BP_B	BP_C	BP_D
BP_B	>0.05	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA
BP_D	>0.05	>0.05	>0.05	NA
BP_E	>0.05	>0.05	>0.05	>0.05
BP_E_F	0.02	0.01	0.02	0.03
BP_F	>0.05	>0.05	>0.05	>0.05

BP_G	0.02	0.01	0.01	>0.05

se testing			Min.	1st Qu.	Median
		Quartz	8.16	14.6	19.4
		Quartzite	13.45	23.28	26.85
		Rhyolite	21.77	21.77	21.77
		Siliceous	8.24	15.58	18.2
		Quartz	1.12	10.11	13.41
		Quartzite	4.26	15.48	19.76
		Rhyolite	20.37	20.37	20.37
		Siliceous	3.9	7.663	11.7
		Quartz	18.02	174.4	255
		Quartzite	100.1	369.1	561.3
		Rhyolite	443.5	443.5	443.5
		Siliceous	32.14	123.5	201.6

			Min.	1st Qu.	Median
E	F	A	8.16	9.9	12.1
NA	NA	B	11.96	13.85	16.75
NA	NA	C	12.48	14.98	18.84
NA	NA	D	12.44	15.8	18.82
NA	NA	E	12.48	18.33	23.59
>0.05	NA	F	19.13	23.21	27.29
>0.05	>0.05	G	12.16	20.92	25.78
E	F	A	3.52	4.52	6.89
NA	NA	B	1.12	12.24	13.72
NA	NA	C	6.43	11.44	13.4
NA	NA	D	5.86	11.28	12.24
NA	NA	E	7.07	9.15	15.6
>0.05	NA	F	8.94	9.425	9.91
>0.05	>0.05	G	3.83	15.89	19.48
E	F	A	29.64	51.3	115.4
NA	NA	B	18.02	174.8	186.4
NA	NA	C	93.17	204.1	263.2
NA	NA	D	82.45	174.6	214.4
NA	NA	E	88.23	229.2	368
>0.05	NA	F	189.6	230.9	272.3
>0.05	>0.05	G	46.57	356.8	529.1

E	E_F	F

NA	NA	NA
NA	NA	NA
NA	NA	NA
NA	NA	NA
>0.05	NA	NA
>0.05	>0.05	NA
>0.05	>0.05	>0.05

E_F	F
NA	NA
NA	NA
NA	NA
NA	NA
>0.05	NA
>0.05	>0.05

	Complex	Cortical
Blade	16	1
Flake	26	1

	Min.	1st Qu.	Median
Bidirection	0.03854	0.302	0.39
Multidirec	0.0583	0.289	0.4117
Unidirectio	0.03744	0.433	0.5486

	Min.	1st Qu.	Median	Mean
Quartz	2.21	7.48	12.11	12.79
Quartzite	3.49	11.4	16.69	19.37
Rhyolite	12.01	17.5	23.49	26.1
Siliceous	2.9	5.11	8.3	9.383
Quartz	0.79	2.725	4.34	4.827
Quartzite	1.04	3.953	6.5	7.094
Rhyolite	4.28	5.75	6.8	7.764
Siliceous	0.46	1.88	2.39	3.251
Quartz	2.994	21.09	49.68	77.68
Quartzite	5.154	45.73	104.3	166
Rhyolite	61.03	105.2	143.3	217.2
Siliceous	1.348	10.01	18.84	38.19
Quartz	0.00476	0.09349	0.1532	0.1737
Quartzite	0.01	0.08527	0.136	0.167
Rhyolite	0.06206	0.09375	0.1276	0.1602
Siliceous	0.00694	0.06705	0.09033	0.1133

	Complex	Cortical	Crushed/B	Dihedral
Quartz	57	0	23	34
Quartzit	35	10	22	59
Rhyolite	3	0	0	0
Siliceou	1	2	5	12

	Min.	1st Qu.	Median	Mean
Blade	2.21	4.93	6.43	7.83
Core Mana	3.49	11.24	16.73	18.39
Flake	2.7	9.66	14.56	16.65
Point	6.64	14.3	18.05	19.38
Blade	0.71	1.83	2.35	3.105
Core Mana	1.29	4.125	6.68	7.427
Flake	0.46	3.185	5.21	6.01
Point	1.09	4.28	6.47	6.815
Blade	2.84	9.413	13.41	30.76
Core Mana	7.469	45.37	107.1	162.5
Flake	1.348	33.9	75.47	126.5
Point	17.59	61.98	102.7	152
Blade	0.00694	0.0761	0.1085	0.1206
Core Mana	0.01026	0.0624	0.1039	0.1552
Flake	0.00476	0.09007	0.147	0.173
Point	0.01901	0.09881	0.1644	0.157

	No	Yes
Blade	120	6
Core_Man	72	10
Flake	652	55
Point	33	10

	Complex	Cortical	Crushed/B	Dihedral
Blade	7	0	5	5
Core_Man	8	0	5	12
Flake	75	12	39	80
Point	6	0	1	8

				Min.	1st Qu.	Median	Mean
BP_E	BP_E_F	BP_F	A	2.85	6.07	7.82	8.859
NA	NA	NA	B	5.7	10.54	12.86	13.47
NA	NA	NA	C	2.7	5.96	10.32	10.41
NA	NA	NA	D	3.33	7.86	12.82	13.29
NA	NA	NA	E	2.21	10.23	15.09	15.1

>0.05	NA	NA	E_F	3.58	10.51	17.43	17.43
>0.05	>0.05	NA	F	3.35	6.47	12.41	11.41
>0.05	>0.05	>0.05	G	5.1	10.33	16.04	17.83
BP_E	BP_E_F	BP_F	A	1.04	1.78	2.97	3.503
NA	NA	NA	B	1.57	3.685	4.68	5.227
NA	NA	NA	C	0.79	2.252	3.21	3.88
NA	NA	NA	D	1.51	2.535	4.405	4.722
NA	NA	NA	E	2	3.808	5.46	5.361
>0.05	NA	NA	E_F	1.33	5.28	9.23	9.23
>0.05	>0.05	NA	F	1.12	3	4.8	4.702
>0.05	>0.05	>0.05	G	1.73	3.88	5.97	7.242
BP_E	BP_E_F	BP_F	A	3.306	10.38	24.38	37.57
NA	NA	NA	B	11.72	40.07	59.06	77.43
NA	NA	NA	C	2.994	13.21	34.45	46.23
NA	NA	NA	D	5.228	21.15	54.69	73.96
NA	NA	NA	E	4.619	40.93	85.32	92.81
>0.05	NA	NA	E_F	4.761	137.6	270.4	270.4
>0.05	>0.05	NA	F	3.763	28.96	55.79	59.7
>0.05	>0.05	>0.05	G	8.823	48.12	104	185.6

				Min.	1st Qu.	Median	Mean
BP_E	BP_E_F	BP_F	A	9.15	11.27	12.38	12.61
NA	NA	NA	B	3.84	9.955	13.56	16.09
NA	NA	NA	C	3.7	10.47	14.76	17
NA	NA	NA	D	6.55	12.2	17.57	20.44
NA	NA	NA	E	4.19	9.23	16.26	17.67
>0.05	NA	NA	E_F	13.44	22.14	33.98	31.83
>0.05	0.04	NA	F	3.49	11.23	15.58	16.2
>0.05	>0.05	>0.05	G	4.56	14.68	20.23	22.83
BP_E	BP_E_F	BP_F	A	2.85	3.365	3.975	3.857
NA	NA	NA	B	1.66	3.65	5.57	6.536
NA	NA	NA	C	1.1	3.61	5.67	6.447
NA	NA	NA	D	2.07	3.57	6.66	7.621
NA	NA	NA	E	1.23	3.18	5.16	5.914
0.02	NA	NA	E_F	5.41	8.79	13.02	12.35
>0.05	0.02	NA	F	2.14	3.195	5.38	6.373
0.05	>0.05	0.03	G	1.04	5.158	7.395	8.014
BP_E	BP_E_F	BP_F	A	29.74	45.07	47.85	48.37
NA	NA	NA	B	8.018	36.74	83.64	127.4
NA	NA	NA	C	6.544	42.94	83.87	133.1
NA	NA	NA	D	17.19	41.78	109.2	196.3
NA	NA	NA	E	5.154	25.22	87.12	124.4
0.02	NA	NA	E_F	72.71	244.2	441.5	418.8
>0.05	0.02	NA	F	7.469	39.6	68.56	124

0.03	>0.05	0.02	G	9.413	76.56	141.4	209.2

Mean	3rd Qu.	Max.	NA's
20.53	25.03	47.23	3
29.65	33.89	62.37	1
21.77	21.77	21.77	
16.68	19.1	21.13	2
14.32	19.56	36.69	3
20.25	24.86	50.45	1
20.37	20.37	20.37	
10.92	14.4	17.3	2
324.4	451.6	1184	3
640.1	740.1	3147	1
443.5	443.5	443.5	
192.2	274.3	311.4	2

Mean	3rd Qu.	Max.	NA's
12.64	14.91	19.68	
17.45	19.29	25.58	
18.93	22.85	25.57	
20.17	24.9	28.57	2
21.85	25.14	27.75	1
25.63	28.88	30.46	
25.95	31.81	37.47	
8.247	11.66	13.8	
13.76	17.46	20.86	
13.68	14.8	20.92	
16.68	19.69	36.69	2
15.69	21.39	24.29	1
10.02	10.56	11.21	
19.57	21.56	32.82	
109.7	152.7	205.8	
251.4	365.5	533.6	
264.3	302	503.8	
377.1	510	973.8	2
356.1	423.6	668.2	1
255.9	289.1	305.9	
542.1	612	1184	

Crushed/B	Dihedral	Simple
1	0	60
4	9	39

Mean	3rd Qu.	Max.	NA's
0.3735	0.4759	0.5631	2
0.4692	0.6257	1.098	3
0.5539	0.6744	0.9768	

3rd Qu.	Max.	NA's
16.09	60.08	108
25.3	68.34	89
33.71	44.75	
11.23	28.17	28
6.32	25.61	108
8.815	23.64	88
9.51	12.75	
3.81	11.89	28
97.47	1539	108
222.4	908.9	89
288.6	528.6	
53.92	264.9	28
0.2376	0.6798	108
0.2261	0.7339	89
0.1959	0.3523	
0.1327	0.4079	28

Punctiform	Simple
43	138
31	245
0	4
20	30

3rd Qu.	Max.	NA's
10.08	42.87	45
23.16	51.83	2
21.08	68.34	177
22.05	51.38	2
3.72	13.27	45
9.235	22.07	2
7.78	25.61	176
8.48	17.39	2
31.45	240.1	45
203.1	737.6	2
153	1539	177
188.8	843.7	2
0.1479	0.3166	45
0.213	0.6798	2
0.2359	0.7339	177
0.1991	0.3725	2

Punctiform	Simple
29	36
10	46
52	312
3	23

3rd Qu.	Max.	NA's
10	27.65	20
16.05	26.93	16
13.16	29.9	25
17.77	26.86	18
20.28	26.86	6

24.36	31.29	
13.84	24.82	4
20.64	60.08	9
4.46	10.9	20
6.68	10	16
4.895	9.14	25
6.41	13.68	18
6.79	11.03	6
13.18	17.13	
6.22	7.68	4
8.7	25.61	9
48.27	183.6	20
103.9	267.7	16
72.06	174.5	25
107.7	311.8	18
135.2	248.4	6
403.2	536	
79.83	185.4	4
188.9	1539	9

3rd Qu.	Max.	NA's
13.58	16.87	2
22.58	38.43	11
21.68	47.59	31
28.08	49.67	18
23.74	44.83	
40.89	49.3	1
20.73	28.36	6
29.2	68.34	15
4.292	4.78	2
8.65	22.07	10
8.47	16.85	31
9.248	19.8	18
8.33	12.74	
15.59	17.54	1
7.575	17.56	6
9.685	23.64	15
52.88	66.06	2
175.3	599	11
171.4	690.1	31
221.9	737.6	18
181.4	532.7	
614.8	728.3	1
159.2	498	6

287.4	908.9	15

Results of Pairwise testing (adjusted p-values) where a significant relationship is identified by Groupwise t

Raw Material

Flake Axial Length	Quartz	Quartzite	Rhyolite
Quartzite	0.00	-	-
Rhyolite	0.00	>0.05	-
Siliceous	>0.05	0.00	0.00

Flake Axial Proximal Width	Quartz	Quartzite	Rhyolite
Quartzite	0.00	-	-
Rhyolite	0.00	>0.05	-
Siliceous	0.00	0.00	0.00

Flake Axial Medial Width	Quartz	Quartzite	Rhyolite
Quartzite	0.00	-	-
Rhyolite	0.00	0.02	-
Siliceous	0.00	0.00	0.00

Flake Axial Distal Width	Quartz	Quartzite	Rhyolite
Quartzite	0.00	-	-
Rhyolite	0.01	>0.05	-
Siliceous	>0.05	0.00	0.00

Flake Proximal Shape	Quartz	Quartzite	Rhyolite
Quartzite	0.04	-	-
Rhyolite	>0.05	>0.05	-
Siliceous	>0.05	>0.05	>0.05

Flake Distal Shape	Quartz	Quartzite	Rhyolite
Quartzite	>0.05	-	-
Rhyolite	>0.05	>0.05	-
Siliceous	>0.05	>0.05	>0.05

Flake Elongation	Quartz	Quartzite	Rhyolite
Quartzite	>0.05	-	-
Rhyolite	>0.05	>0.05	-
Siliceous	0.04	>0.05	>0.05

Debitage Type

Flake Axial Length	Blade	Core_Man	Flake
Core_Management	0.00	-	-
Flake	>0.05	0.00	-
Point	0.00	>0.05	0.00

Flake Axial Proximal Width	Blade	Core_Man	Flake
Core_Management	0.00	-	-
Flake	0.00	0.00	-
Point	0.00	>0.05	0.01

Flake Axial Medial Width	Blade	Core_Man	Flake
Core_Management	0.00	-	-
Flake	0.00	0.00	-
Point	0.00	>0.05	>0.05

Flake Axial Distal Width	Blade	Core_Man	Flake
Core_Management	0.00	-	-
Flake	0.00	0.00	-
Point	0.00	0.00	>0.05

Flake Proximal Shape	Blade	Core_Man	Flake
Core_Management	0.00	-	-
Flake	0.00	>0.05	-
Point	>0.05	0.04	>0.05

Flake Distal Shape	Blade	Core_Man	Flake
Core_Management	>0.05	-	-
Flake	>0.05	>0.05	-
Point	0.00	0.00	0.00

Flake Elongation	Blade	Core_Man	Flake
Core_Management	0.00	-	-
Flake	0.00	0.02	-
Point	0.00	>0.05	>0.05

Flake Dorsal Scar Pattern	Blade	Core_Man	Flake
Core_Management	0.00	NA	NA
Flake	0.00	0.00	NA
Point	0.00	0.00	0.00

Flake Termination Type	Blade	Core_Man	Flake
Core_Management	0.00		
Flake	>0.05	0.00	
Point	0.03	0.00	>0.05

Quartz

Flake Axial Length	A	B	C	D
B	>0.05	NA	NA	NA
C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	0.02	>0.05	>0.05	>0.05
E-F	>0.05	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	0.00	0.01	0.00	0.01

Flake Axial Proximal Width	A	B	C	D
B	0.01	NA	NA	NA

C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	0.02	>0.05	>0.05	>0.05
E-F	>0.05	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	0.01	>0.05	>0.05	>0.05

Flake Axial Medial Width	A	B	C	D
B	0.04	NA	NA	NA
C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	0.01	>0.05	>0.05	>0.05
E-F	>0.05	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	0.00	>0.05	>0.05	0.03

Flake Axial Distal Width	A	B	C	D
B	>0.05	NA	NA	NA
C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	0.02	>0.05	0.02	0.02
E-F	>0.05	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	0.01	>0.05	0.01	0.01

Flake Proximal Shape	A	B	C	D
B	>0.05	NA	NA	NA
C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	0.04	NA
E	>0.05	>0.05	>0.05	>0.05
E-F	>0.05	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	>0.05	>0.05	>0.05	0.04

Flake Dorsal Scar Pattern	A	B	C	D
B	>0.05	NA	NA	NA
C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	>0.05	>0.05	>0.05	>0.05
E-F	>0.05	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	>0.05	>0.05	>0.05	>0.05

Flake Termination Type	A	B	C	D
B	>0.05	NA	NA	NA
C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA

E	>0.05	>0.05	>0.05	>0.05
E-F	>0.05	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	>0.05	>0.05	>0.05	>0.05

Quartzite

Flake Axial Length	A	B	C	D
B	0.01	NA	NA	NA
C	0.01	>0.05	NA	NA
D	0.01	>0.05	>0.05	NA
E	0.01	>0.05	>0.05	>0.05
E-F	0.01	>0.05	>0.05	>0.05
F	0.01	>0.05	>0.05	>0.05
G	0.01	>0.05	0.01	>0.05

Flake Axial Proximal Width	A	B	C	D
B	>0.05	NA	NA	NA
C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	>0.05	>0.05	>0.05	>0.05
E-F	0.05	0.04	0.04	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	0.04	0.03	0.01	>0.05

Flake Axial Medial Width	A	B	C	D
B	>0.05	NA	NA	NA
C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	>0.05	>0.05	>0.05	>0.05
E-F	0.04	0.02	0.01	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	0.02	0.00	0.00	>0.05

Flake Axial Distal Width	A	B	C	D
B	>0.05	NA	NA	NA
C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	>0.05	>0.05	>0.05	>0.05
E-F	>0.05	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05
G	>0.05	0.00	0.00	>0.05

Flake Elongation	A	B	C	D
B	>0.05	NA	NA	NA
C	>0.05	>0.05	NA	NA
D	>0.05	>0.05	>0.05	NA
E	>0.05	>0.05	>0.05	>0.05
E-F	>0.05	>0.05	>0.05	>0.05
F	>0.05	>0.05	>0.05	>0.05

G	>0.05		>0.05	>0.05	>0.05

Quartzite Blade Technology

BP G Comparative Axial Length	Blade Core	
Blade		0.01

Quartz Flake Technology

BP A Comparative Axial Length	Core	
Flake		0.00

BP A Comparative Medial Axial Width	Core	
Flake		0.04

BP A Comparative Surface Area	Core	
Flake		0.01

BP B Comparative Medial Axial Width	Core	
Flake		0.01

BP B Comparative Surface Area	Core	
Flake		0.03

BP E Comparative Axial Length	Core	
Flake		0.01

BP E Comparative Medial Axial Width	Core	
Flake		0.00

BP E Comparative Surface Area	Core	
Flake		0.00

BP G Comparative Surface Area	Core	
Flake		0.03

Quartzite Flake Technology

BP C Comparative Medial Axial Width	Core	
Flake		0.04

BP C Comparative Surface Area	Core	
Flake		0.05

BP G Comparative Medial Axial Width	Core	
Flake		0.00

BP G Comparative Surface Area	Core	
Flake		0.00

	Min.	1st Qu.	Median	Mean
Quartz	6.09	14.84	18.8	20.37
Quartzite	8.18	22.74	30.22	31.08
Rhyolite	20.73	26.3	33.23	31.86
Siliceous	8.39	12.43	16.97	18.51
Quartz	3.41	8.9	13.31	13.79
Quartzite	4.51	14	18.74	20.96
Rhyolite	14.74	22.76	25.01	27.38
Siliceous	3.56	7.218	10.28	11.16
Quartz	3.72	9.72	14.6	15.37
Quartzite	3.6	17.04	23.68	24.78
Rhyolite	19.68	27.9	38.02	34.63
Siliceous	4.37	7.132	11.93	12.32
Quartz	3.05	8.352	11.94	13.41
Quartzite	2.24	14.4	19.66	21.39
Rhyolite	14.05	17.31	23.71	23.76
Siliceous	3.02	7.19	9.51	11.39
Quartz	0.4555	0.7304	0.8909	0.8953
Quartzite	0.3169	0.6971	0.8258	0.8382
Rhyolite	0.5236	0.5454	0.6673	0.7822
Siliceous	0.4623	0.7408	0.87	0.8762
Quartz	0.7366	1.038	1.22	1.299
Quartzite	0.7312	1.034	1.22	1.271
Rhyolite	1.271	1.351	1.416	1.457
Siliceous	0.6547	0.9177	1.049	1.204
Quartz	0.514	1.043	1.427	1.567
Quartzite	0.2507	1.18	1.587	1.618
Rhyolite	0.9337	1.061	1.374	1.329
Siliceous	0.5302	1.345	1.735	1.92

	Min.	1st Qu.	Median	Mean
Blade	9.96	14.9	18.56	21.49
Core Man	13.76	23.28	31.17	34.26
Flake	6.09	16.34	22.7	24.61
Point	13.77	24.53	31.06	31.72
Blade	4.25	6.255	7.91	8.985
Core Man	5.97	15.14	19.12	20.97
Flake	3.41	11.74	16.22	17.89
Point	9.91	15.65	18.18	20.9

Blade	3.6	6.453	7.91	9.267
Core Man	8.01	17.08	24.96	25.68
Flake	3.72	13.78	19.31	21.15
Point	7.71	16.95	20.16	23.2

Blade	2.24	5.04	6.61	6.813
Core Man	7.03	15.26	20.69	22.09
Flake	3.02	10.67	16.05	17.9
Point	4.86	9.235	14.25	16.06

Blade	0.7304	0.891	0.963	0.9997
Core Man	0.3169	0.6862	0.7792	0.826
Flake	0.443	0.6985	0.8464	0.8526
Point	0.5521	0.7515	0.9355	0.9193

Blade	0.8833	1.033	1.191	1.276
Core Man	0.7142	1.003	1.197	1.244
Flake	0.6547	1.021	1.197	1.252
Point	0.8141	1.394	1.551	1.584

Blade	1.625	2.252	2.606	2.548
Core Man	0.6162	1.271	1.646	1.739
Flake	0.2507	1.061	1.454	1.546
Point	0.514	1.323	1.549	1.627

	Bidirection	Bilateral	Distal	Lateral
Blade	13	0	1	1
Core_Man	10	5	3	12
Flake	109	10	32	25
Point	15	1	0	1

	Axial	Bipolar	Feather	Hinge
Blade	0	0	39	1
Core_Man	20	2	47	0
Flake	23	6	422	19
Point	0	0	41	0

					Min.	1st Qu.	Median	Mean
E	E-F	F		A	8.06	13.57	16.58	17.16
NA	NA	NA		B	9.44	14.86	17.78	19.16
NA	NA	NA		C	9.21	15.49	17.84	18.84
NA	NA	NA		D	8.43	14.48	18.44	20.01
NA	NA	NA		E	10.68	17.42	22.68	23.5
>0.05	NA	NA		E_F	13.24	22.23	31.22	31.22
>0.05	>0.05	NA		F	9.26	12.4	14.06	15.87
>0.05	>0.05		0.01	G	12.31	23.45	29.98	27.98

E	E-F	F		A	4.31	7.34	8.95	10.31
NA	NA	NA		B	5.62	12.95	15.34	15.3

NA	NA	NA	C	4.18	8.045	12.18	11.61
NA	NA	NA	D	3.41	8.465	12.66	13.21
NA	NA	NA	E	5	13.2	16.19	17.37
>0.05	NA	NA	E_F	4.04	11.07	18.1	18.1
>0.05	>0.05	NA	F	4.18	5.805	13.31	13
>0.05	>0.05	>0.05	G	9.2	13.44	16.16	17.21

E	E-F	F	A	4.47	7.538	10.27	11.63
NA	NA	NA	B	7.71	13.9	16.58	17.52
NA	NA	NA	C	4.72	8.825	13.33	13.69
NA	NA	NA	D	3.72	10.3	12.56	14.14
NA	NA	NA	E	5.22	17.14	19.77	20.74
>0.05	NA	NA	E_F	7.55	15.72	23.88	23.88
>0.05	>0.05	NA	F	5.82	7.71	14.48	14.64
>0.05	>0.05	>0.05	G	12.01	18.47	20.97	22.02

E	E-F	F	A	3.57	5.475	10.27	11.06
NA	NA	NA	B	4.86	10.22	12.65	14.5
NA	NA	NA	C	3.71	8.102	10.68	11.37
NA	NA	NA	D	3.05	7.002	8.355	11.43
NA	NA	NA	E	6.62	9.92	15.47	16.46
>0.05	NA	NA	E_F	8.3	19.21	30.12	30.12
>0.05	>0.05	NA	F	4.03	7.2	14.42	12.93
>0.05	>0.05	>0.05	G	9.33	13.55	17.16	18.89

E	E-F	F	A	0.578	0.7178	0.8712	0.9204
NA	NA	NA	B	0.6028	0.6749	0.8663	0.8835
NA	NA	NA	C	0.4555	0.6888	0.8239	0.8259
NA	NA	NA	D	0.4906	0.9026	0.9629	0.9764
NA	NA	NA	E	0.6343	0.7245	0.7887	0.8604
>0.05	NA	NA	E_F	0.5351	0.6012	0.6672	0.6672
>0.05	>0.05	NA	F	0.6411	0.76	0.877	0.845
>0.05	>0.05	>0.05	G	0.5508	0.7182	0.736	0.7852

				Bidirection	Bilateral	Distal	Lateral
E	E-F	F	A	8	0	4	0
NA	NA	NA	B	8	0	3	3
NA	NA	NA	C	16	1	5	4
NA	NA	NA	D	9	1	2	6
NA	NA	NA	E	7	1	1	1
>0.05	NA	NA	E_F	0	0	1	0
>0.05	>0.05	NA	F	3	0	1	0
>0.05	>0.05	>0.05	G	4	2	1	0

				Axial	Bipolar	Feather	Hinge
E	E-F	F	A	1	0	38	0
NA	NA	NA	B	2	0	31	2
NA	NA	NA	C	2	0	41	1
NA	NA	NA	D	0	0	46	0

NA	NA	NA	E	2	0	23	0
>0.05	NA	NA	E_F	0	0	2	0
>0.05	>0.05	NA	F	1	1	7	0
>0.05	>0.05	>0.05	G	1	2	14	0

				Min.	1st Qu.	Median	Mean
E	E-F	F	A	8.18	9.48	13.42	14.09
NA	NA	NA	B	8.96	21.02	27.96	28.91
NA	NA	NA	C	8.79	20.93	26.63	28.42
NA	NA	NA	D	10.31	21.58	31.57	30.21
NA	NA	NA	E	13.71	22.89	27.52	32.15
>0.05	NA	NA	E_F	27.8	30.62	36.02	34.14
>0.05	>0.05	NA	F	16.29	22.72	33.57	32.28
>0.05	>0.05	>0.05	G	9.96	25.54	32.07	33.07
E	E-F	F	A	9.45	11.98	13.6	14
NA	NA	NA	B	5.21	11.68	16.91	18.3
NA	NA	NA	C	4.51	12.77	16.82	18.7
NA	NA	NA	D	6.56	12.35	21.05	21.64
NA	NA	NA	E	4.64	15.14	18.87	21.24
>0.05	NA	NA	E_F	13.9	24.93	34.88	32.21
>0.05	>0.05	NA	F	6.24	20.29	23.88	21.97
>0.05	>0.05	>0.05	G	5.1	15.93	20.46	22.74
E	E-F	F	A	12.5	13.34	13.93	16.08
NA	NA	NA	B	5.66	13.66	21.27	20.89
NA	NA	NA	C	4.03	14.02	18.94	20.14
NA	NA	NA	D	6.89	19.66	27.47	28.87
NA	NA	NA	E	5.23	18.6	25.98	25.64
>0.05	NA	NA	E_F	18.21	30.36	32.74	35.87
>0.05	>0.05	NA	F	12.75	18.4	30.07	25.98
>0.05	>0.05	>0.05	G	3.6	22.69	28.48	28.72
E	E-F	F	A	12.89	13.6	14.14	14.85
NA	NA	NA	B	5.64	11.08	16.47	17.39
NA	NA	NA	C	2.74	12.13	16.08	18.25
NA	NA	NA	D	6.6	16.88	20.31	24.67
NA	NA	NA	E	4.44	11.92	20.34	20.87
>0.05	NA	NA	E_F	10.08	22.28	26.32	26.48
>0.05	>0.05	NA	F	10.8	14.99	19.54	22.93
>0.05	>0.05	>0.05	G	2.24	18.09	23.88	24.25

E	E-F	F
NA	NA	NA
NA	NA	NA
NA	NA	NA
NA	NA	NA
>0.05	NA	NA
>0.05	>0.05	NA

>0.05	>0.05	>0.05

	Min.	1st Qu.	Median	Mean
Core	157.9	237.4	264.5	336.4
Flake	46.4	54.08	61.75	116.4

	Min.	1st Qu.	Median	Mean
Core	8.08	9.205	11.24	11.05
Flake	8.06	13.52	16.62	17.26
Core	6.68	6.838	7.225	10.37
Flake	4.47	9.45	12.87	13.42
Core	55.51	67.96	81.94	115.3
Flake	36.03	139.6	202.1	253
Core	9.11	10.28	11.45	10.72
Flake	7.71	14.17	16.58	17.82
Core	64.68	109.9	155.2	149.4
Flake	137.5	225.7	327.3	344.9
Core	0	11.68	15.34	13.19
Flake	10.68	16.68	22.45	23.45
Core	0	7.365	9.8	9.163
Flake	5.22	17.25	20.07	21.3
Core	61.23	132	156.5	168.1
Flake	62.12	342.9	447.2	531.9
Core	157.9	269.7	386.6	358.5
Flake	147.8	395	648.3	629

	Min.	1st Qu.	Median	Mean
Core	13.03	14.43	15.49	16.86
Flake	5.55	16.02	21.1	22.54
Core	222.2	229.7	365.2	393.7
Flake	50.72	355.6	579.7	726.6
Core	11.66	18.54	21.46	19.91
Flake	12.28	23.04	28.95	29.58
Core	173.2	476.3	557	548.6
Flake	233.9	619.5	912.3	1025

3rd Qu.	Max.	NA's
24.23	49.19	161
37.7	70.13	144
35.8	44.82	
22.44	37.92	47
17.09	34.35	140
26.67	59.56	119
32.49	41.43	
12.03	27.97	35
19.54	43.99	122
31.26	57.38	116
41.94	45.02	
15.08	40.49	35
17.28	51.94	185
27.86	60.62	171
30.16	33.6	1
15	27.27	48
1.035	1.469	202
0.965	1.61	187
0.9592	1.274	1
1.038	1.32	51
1.478	2.554	206
1.455	2.46	190
1.461	1.832	1
1.409	2.542	51
1.899	4.268	206
1.973	4.963	190
1.501	1.792	1
2.403	3.97	51

3rd Qu.	Max.	NA's
28.78	37.09	98
41.74	70.13	8
31.51	64.25	244
38.48	52.77	3
11.7	19.03	54
25.59	48.33	3
22.2	59.56	235
25.39	53.68	3

10.98	25.24	31
31.22	50.74	3
27.42	57.38	237
26.18	55.64	3
8.05	18.78	92
28.22	48.89	8
23.34	56.36	303
18.44	60.62	3
1.064	1.469	100
0.9357	1.61	11
0.9841	1.469	326
1.062	1.285	5
1.496	1.807	102
1.488	2.139	11
1.416	2.46	331
1.796	2.554	5
2.743	3.89	102
1.998	4.963	11
1.888	4.268	331
1.859	3.295	5

Perpendicu	Proximal	Radial	Weakly Radial
2	92	0	0
17	9	5	16
69	331	10	39
4	13	2	7

Outrepasse	Step
0	6
1	4
5	33
0	0

3rd Qu.	Max.	NA's
20.62	33.36	25
21.9	31.66	19
21.12	34.44	44
24.08	43.2	25
25.52	40.59	10
40.2	49.19	
18.62	27.75	12
32.57	38.71	13
13.05	27.9	20
17	25.51	16

14.74	21	27
17.14	25.51	28
22.2	33.67	11
25.12	32.15	
17.27	26.09	10
21.01	28.24	16
15.68	22.71	13
19.83	31.89	17
17.84	31.89	16
18.98	28.71	28
25.12	43.99	11
32.05	40.22	
18.44	29.53	10
24.62	38.37	16
14.23	30.83	29
17.1	29.57	25
14.3	23.05	43
14.76	28.46	30
19.66	40.89	11
41.03	51.94	
17.52	19.76	12
23.19	39.79	16
1.09	1.469	33
1.068	1.285	27
0.9507	1.259	52
1.119	1.379	31
0.9579	1.35	11
0.7333	0.7994	
0.9235	0.9933	11
0.8983	1.057	17

Perpendicu	Proximal	Radial	Weakly Radial
6	41	0	0
1	27	0	2
3	43	0	2
4	30	1	2
2	15	1	3
0	1	0	0
2	8	0	1
2	11	2	5

Outrepasse	Step
0	3
0	1
0	5
0	0

0	1
0	0
0	1
2	1

3rd Qu.	Max.	NA's
19.09	20.26	3
33.78	70.13	16
34.84	61.65	55
35.42	66.68	15
38.31	69.55	8
37.4	39.09	4
37.73	55.68	9
41.31	60.92	25
16.07	19.02	2
24.12	38.99	11
24.14	47.97	34
27.44	48.33	23
27.85	44.86	7
40.2	49.33	1
26.83	29.62	12
28.3	59.56	24
19.88	20.73	3
28.99	35.96	11
25.34	51.76	30
36.1	57.31	23
35.38	43.41	7
44.62	47.73	2
32.03	33.16	11
33.58	57.38	23
15.39	18.24	4
21.88	40.29	16
23.61	48.89	62
32.47	45.9	25
30.4	43.51	9
34.86	37.54	5
32.23	35.3	11
29.1	56.36	28

3rd Qu.	Max.	NA's
323.6	1036	
151.3	240.9	4

3rd Qu.	Max.	NA's
12.43	14.84	
20.72	33.36	12
8.998	27.4	
17.44	22.71	12
125.5	294.6	
362.4	736.6	20
11.52	11.59	
20.08	31.89	17
191.8	228.4	
461.9	725.7	24
16.48	20.66	
25.75	40.59	8
10.36	18.89	
25.14	43.99	9
204.8	289.8	1
691.6	1786	9
427.5	570.5	
761.7	1485	12

3rd Qu.	Max.	NA's
19.7	23.26	
27.5	51.76	26
486	718.5	
866.4	3091	44
22.69	26.33	
35.42	57.38	20
630.1	899.4	
1299	2645	24

Results of Pairwise testing (adjusted p-values) where a significant relationship is identified by Groupwise

Retouched Max Length	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F
BP_B	>0.05	-	-	-	-	-
BP_C	>0.05	>0.05	-	-	-	-
BP_D	>0.05	>0.05	>0.05	-	-	-
BP_E	>0.05	>0.05	>0.05	>0.05	-	-
BP_E_F	>0.05	>0.05	0.02	>0.05	>0.05	-
BP_F	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
BP_G	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Quartz

Comparative Length	Core	Flake	Flaked_Piece
Flake	0.00	-	-
Flaked_Piece	0.05	>0.05	-
RT	0.00	0.05	0.03

Comparative Width	Core	Flake	Flaked_Piece
Flake	0.00	-	-
Flaked_Piece	0.00	>0.05	-
RT	0.00	>0.05	>0.05

Comparative Elongation	Core	Flake	Flaked_Piece
Flake	0.00	-	-
Flaked_Piece	0.03	>0.05	-
RT	0.04	>0.05	>0.05

Comparative Surface Area	Core	Flake	Flaked_Piece
Flake	0.00	-	-
Flaked_Piece	0.00	>0.05	-
RT	0.00	>0.05	0.05

Quartzite

Comparative Length	Core	Flake	Flaked_Piece
Flake	0.00	-	-
Flaked_Piece	>0.05	0.00	-
RT	0.00	0.01	0.00

Comparative Width	Core	Flake	Flaked_Piece
Flake	0.00	-	-
Flaked_Piece	0.04	0.00	-
RT	0.00	0.04	0.00

Comparative Elongation	Core	Flake	Flaked_Piece
Flake	0.00	-	-
Flaked_Piece	0.00	0.01	-
RT	0.00	>0.05	>0.05

Comparative Surface Area	Core	Flake	Flaked_Piece

Flake	0.00	-	-
Flaked_Piece	>0.05	0.00	-
RT	0.00	0.02	0.00

testing		Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
BP_F	A	11.74	16.05	18.03	19.04	21.67	28.04	
-	B	12.93	18.97	24.14	25.35	30.69	46.03	
-	C	9.09	17	22.7	23.03	26.16	52.26	
-	D	13.28	21.24	24.59	29.22	31.88	60.02	
-	E	12.37	22.38	26.29	30.57	41.51	50.44	
-	E_F	17.22	40.8	48.45	44.83	53.52	64.05	
-	F	13.31	19.41	28.07	27.3	33.67	42	
>0.05	G	11.24	14.71	28.54	30.73	43.75	56.72	

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
Core	6.43	12.58	16.41	17.84	22.36	38.77	3
Flake	8.51	15.7	20.22	21.59	25.49	63.4	
Flaked Piec	9.51	16.16	19.18	20.16	23.15	35.06	
RT	10.57	17.68	22.79	23.95	26.98	64.05	
Core	4.31	6.875	8.82	10.59	12.57	29.73	3
Flake	4.16	10.23	14.24	14.99	18.7	43.28	
Flaked Piec	5.73	9.878	13.42	13.54	15.75	23.48	
RT	3.53	9.58	16.08	16.43	21.08	45.65	
Core	0.3923	1.303	1.858	1.95	2.489	4.175	3
Flake	0.9395	1.198	1.432	1.526	1.732	3.272	
Flaked Piec	1.012	1.207	1.429	1.583	1.759	3.838	
RT	1.043	1.237	1.45	1.632	1.888	4.167	
Core	44.82	99.48	156.9	197.9	231.6	854.1	3
Flake	47.03	153.8	295.4	367.2	472.2	2651	
Flaked Piec	64.19	162.1	248	287.3	394.4	691.4	
RT	51.93	163.6	365.8	463.7	555.2	2924	

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
Core	9.72	21.17	25.74	25.96	29.45	49.56	
Flake	8.09	23.51	33.28	33.99	42.17	85.73	1
Flaked Piec	12.83	16.03	21.03	23.83	29.55	46.61	
RT	9.09	29.9	42	39.11	49.87	60.02	
Core	4.31	7.72	10.38	12.27	16.44	27.65	1
Flake	4.57	16.92	23.41	24.35	31.11	64.62	
Flaked Piec	7.42	10.34	12.42	15.2	17.26	41.07	
RT	4.49	18.99	28.52	28.03	36.14	55.27	
Core	0.6888	1.424	2.387	2.5	3.272	5.301	1
Flake	0.9958	1.18	1.346	1.444	1.59	3.566	1
Flaked Piec	1.061	1.261	1.623	1.682	1.842	3.004	
RT	1.008	1.235	1.44	1.531	1.608	3.209	
Core	69.74	182.2	264.5	329.1	437.5	1036	1

Flake	36.97	432.5	776.5	943.1	1274	4296	1
Flaked Piec	95.2	172.9	296	416.5	504.4	1914	
RT	63.99	593	1295	1228	1715	3093	

Results of Pairwise testing (adjusted p-values) where a significant relationship is identified by Groupwise

Total Retouched Length	BP_A	BP_B	BP_C	BP_D	BP_E	BP_E_F
BP_B	>0.05	NA	NA	NA	NA	NA
BP_C	>0.05	>0.05	NA	NA	NA	NA
BP_D	>0.05	>0.05	>0.05	NA	NA	NA
BP_E	>0.05	>0.05	>0.05	>0.05	NA	NA
BP_E_F	>0.05	>0.05	>0.05	>0.05	>0.05	NA
BP_F	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
BP_G	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

testing
BP_F
NA
NA
NA
NA
NA
NA
>0.05